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INDEX TO CONTENTS, PAGE 385. - - - - - - - - ADVERTISERS' INDEX, PAGE 22.

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STEEL CONSTRUCTION

Pittsburgh

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CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

*The Koppers Combination Coke and Gas Oven..... 385
The Installation of Mains and Pipe Lines of Steel and Wrought Iron, by Mr. H. 388

EDITORIALS—
Briefly Told 392

An Expressed Dissent Respecting National Advertising—Injunction Denied, Fargo, N. D.—December Meeting, New England Section, N. C. G. A.—Current Mention.

*Punched Holes in Structural Steel..... 395
How to Establish a More Intimate Relation between Departments in the Administration of the Gas Business, by Mr. R. C. Ware... 395

NEW METHODS AND APPLIANCES..... 398

*Thermal Performance of a Gas Iron—The Welsbach System of Illuminating Bowling Alleys—A "Miscellaneous" Order Card.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 398

Gas Rate Increase, Mediapolis, Ia.—Odd Construction and Maintenance Methods, Pana, Ills.—Death of Mr. John Quigley—Something from the Zenith City—The Fargo (N. D.) Contention Over Location of Gas Works—The Quality of Biloxi (Miss.) Gas—Again "Prof." Marks—Inspector Cooke and His Ways—And Alton D. Gets another Stint—The Philadelphia Co-Operative Builders' Association—New Gas Rate, Albany, N. Y.—Going Ahead, Austin, Tex.—Recapitalization, Albany and Troy, N. Y.—A Buncombe Story—Increased Capital, Cambridge, Mass.—The Labor Troubles, Pacific Gas and Electric Company—A Peculiar Accident Settlement after Long Delay—A Sorrowful Experience—Kingston and Saugerties (N. Y.) Come Together—And Other Items.

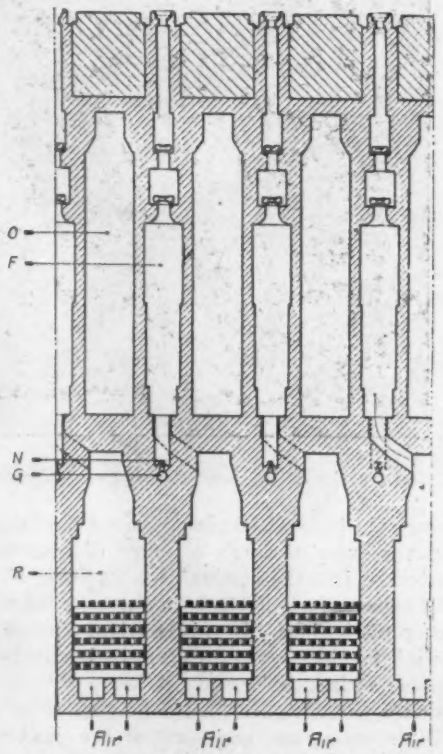
The Market for Gas Securities..... 400
Meeting Times of the Various Gas Associations..... 400
Public Lighting Table for December, 1913 (Advertising Section).. 10

The Koppers Combination Coke and Gas Oven.[1]

Uses in Steel Works and Gas Works.—Recent investigations in modern steel works practice have demonstrated very clearly the great value of coke oven gas as a fuel for steel furnaces. By using a gas which contains relatively a small proportion of nitrogen, and which has at the same time a high calorific value, a much higher efficiency has been obtained from the furnaces; consequently the attention of many steel manufacturers has been drawn to the question of the possibility of obtaining a supply of coke oven gas for this purpose. Blast-furnace or producer gas is not entirely satisfactory for use in steel furnaces, but, unfortunately, with the ordinary type of coke oven sufficient surplus gas is not produced to meet the full requirements of the furnaces. With the usual type of coke oven about half the gas evolved from the coal is required for heating the ovens, the other half only being available for outside purposes.

A few years ago the Koppers horizontal chamber oven was brought out. This oven is heated by means of producer gas made in a central producer plant, the whole of the gas evolved from the coal carbonized in the ovens being utilized as illuminating gas. Instead of producer gas, blast furnace gas could be employed for heating the ovens. Such a system of ovens, therefore, which could be heated by blast furnace gas, and which would leave the whole of the gas available for outside purposes, might be considered suitable for adoption in steel works, where the gas could be utilized for heating the steel furnaces. In many cases, however, the demand for coke oven gas is not constant, but fluctuates greatly according to circumstances. Unless some provision were made, therefore, for storage of the surplus gas, over-production would result. If, however, the heating arrangement of the oven could be quickly changed, and the ovens heated by this surplus gas instead of by blast furnace gas, there would be no difficulty of over-production. To overcome this difficulty the Koppers combination coke and gas oven was designed. This oven can be used at will either as a coke oven or as a gas oven, and as such can be heated either by the surplus gas from the coal or by poorer gas, such as blast furnace or producer gas. In either case the quality of the coke produced is the same. This oven is especially suitable for steel works which have facilities for utilizing the rich coke oven gas for heating the steel furnaces. When coke oven gas is required for the furnaces, the ovens can be heated by blast furnace or producer gas, and thus leave the whole of the coke oven gas available. On the other hand, if for any reason the coke oven gas is not required to the same extent, or if the supply of blast furnace gas is not available, the ovens can be heated by the coke oven gas without any stoppage whatever. The new oven, therefore, combines the advantages of the Koppers coke oven with those of the Koppers gas oven, and the flexibility of operation of the combination oven will be found of great advantage.

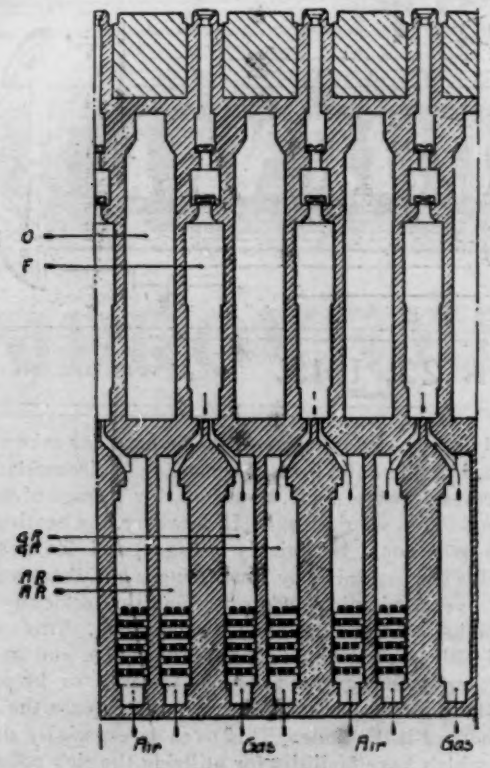
Descriptive.—The following explanation will enable the design and working of the combination oven to be thoroughly understood. For the purpose of comparison we reproduce drawings showing cross-sections through (A) the Koppers regenerative coke oven (B), the Koppers gas oven and (C) the Koppers combination oven.



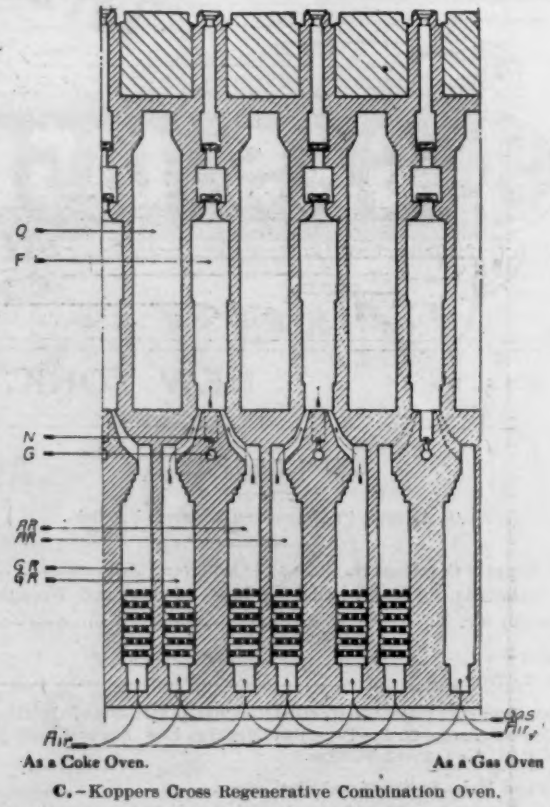
A.—Koppers Cross Regenerative Coke Oven.

1. In the regenerative coke oven about 50 per cent of the gas evolved from the coal is used for the purpose of heating the ovens. After

1, *The Gas World.*



B.—Koppers Cross Regenerative Gas Oven.



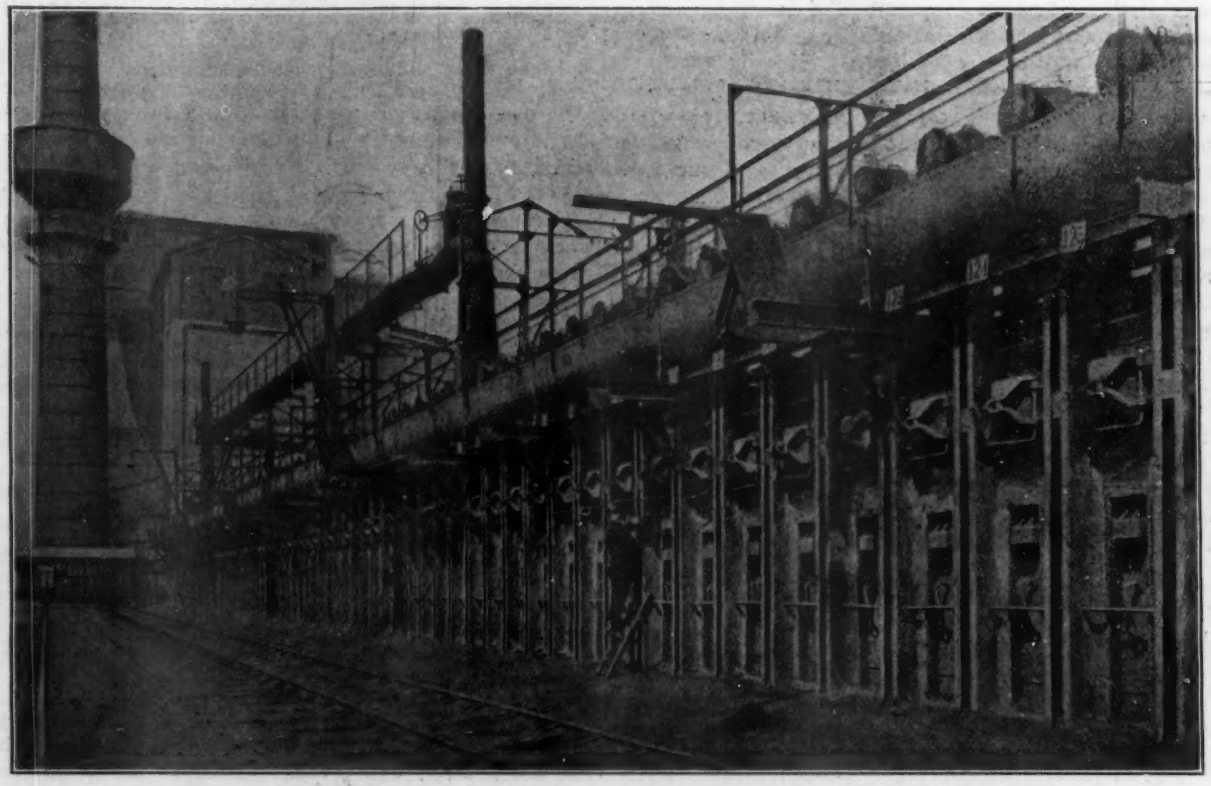
C.—Koppers Cross Regenerative Combination Oven.

Installation of Koppers' Combination Coke and Gas Ovens at the Hosch Iron and Steel Works Dortmund, Germany. View from Coke Bench Side.

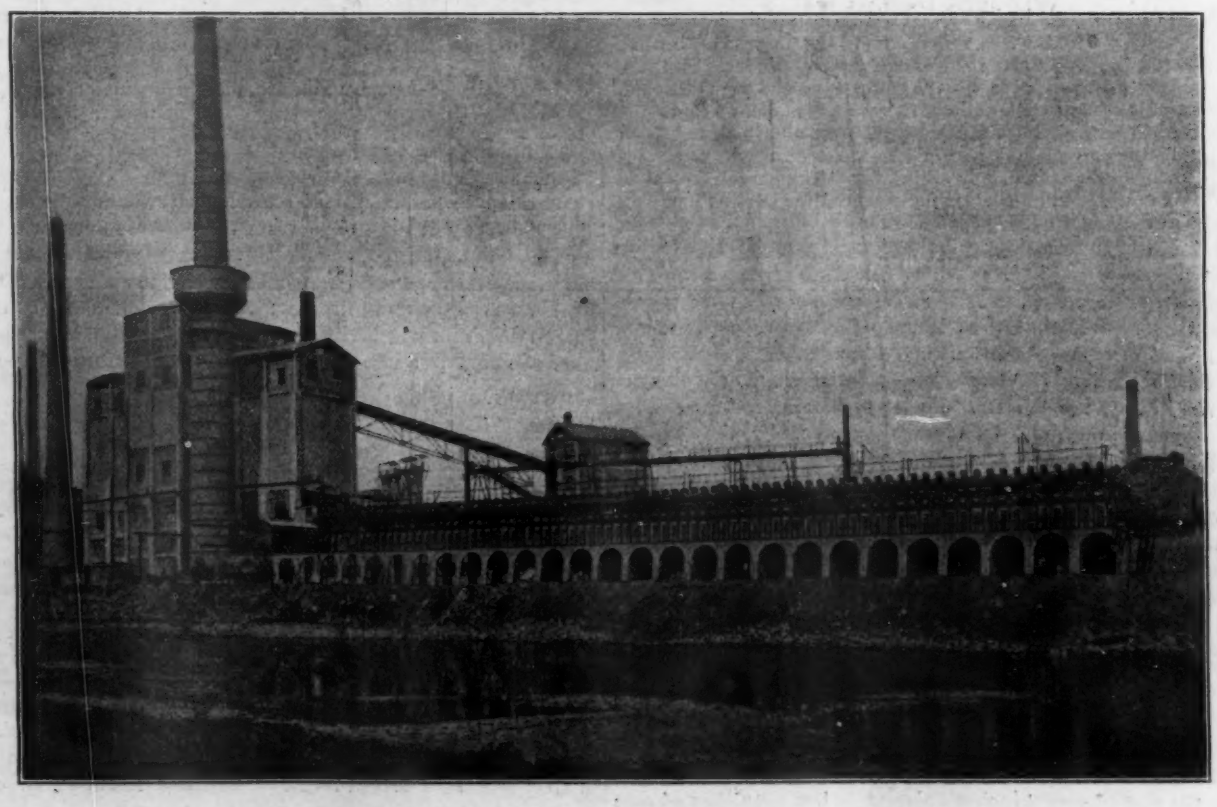
passing through the by-product plant, the required portion of the gas is returned to the ovens through a series of distribution pipes, *G*, through nozzles, *N*, into the vertical heating flues, *F*. Here it meets air which has been preheated to a high degree in the regenerators, *R*, and combustion takes place. In this way the charge of coal is carbonized, and all the gas not required for heating purposes is available for outside consumption.

2. The gas oven was designed for the production of the maximum quantity of illuminating gas, and none of the gas evolved from the coal is used for heating purposes. The ovens are heated by producer gas, generated in a central producer plant, and usually manufactured from inferior fuel. In this type of oven, both the producer gas and the air necessary for its combustion are preheated. For this purpose the regenerators are divided into two sections. The producer gas is preheated by passing through the regenerators, *G*, *R*, and the air by passing through the regenerators *A*, *R*. The gas and air then meet in the vertical flues *F*, where combustion takes place as in the coke oven.

3. This is a combination of the coke oven and the gas oven, and can be used as either at will. The difference lies, of course, in the manner in which the oven is heated. If required as a coke oven, it is heated by coke oven gas, whilst, if required as a gas oven, it is heated by some other gas, such as producer or blast furnace gas. In the latter case the gas must be subjected to a cleaning process to free it from tar and dust. It will be seen from the illustration that the combination oven is provided with divided regenerators, similar to those



Installation of 80 Koppers' Combination Ovens at the Friedrich Wilhelmshutte, Germany. View of Pushing Engine Side.



Installation of 80 Koppers' Combination Coke and Gas Ovens at the Friedrich Wilhelmshutte, Mulheim, Germany.

adopted in the gas oven. At the same time provision is made by means of the distribution channels in *G* for the utilization of coke oven gas for heating, as in the coke oven.

If the combination oven is to be worked as a coke oven, all the regenerators are used to preheat the air. The coke oven gas, freed from its by-products, enters the distributing flue, *G*, and the oven works in exactly the same manner as described above for the working of the coke oven. If the oven is to be worked as a gas oven, one pair of regenerators being used for preheating the air, and the next pair for preheating the producer or blast furnace gas. The heated gas and air meet in the vertical flues, *F*, and combustion takes place, the oven then working in exactly the same manner as described above for the working of the coke oven. The temperature of the oven can be maintained just as easily in one case as in the other, and the change from a gas oven to a coke oven, and *vice versa*, can be made almost instantaneously, and without interfering with the working of the ovens in any way.

Uses in Gas Works.—In addition to being suitable for the production of gas for steel works, the combination oven also lends itself to adoption for ordinary gas works' practice, and, indeed, two such installations have been erected. With other systems of carbonization, to make any substantial alteration in the output, it is necessary to

work additional settings of retorts during times of heavy demand, or to shut down settings when the demand decreases. With the Koppers combination oven this difficulty is avoided. Ordinarily, the ovens may be heated with producer gas, and thus allow the whole of the gas from the coal to be available for sale. If the demand for gas falls off, the poorer portion of it may be used in place of producer gas for heating the ovens. The coal gas may be substituted for the producer gas in any proportion. The volume of the gas used is proportional to its heating value, and hence one method of operating is just as efficient and economical as the other. An installation of 35 of these ovens has been at work for several months at Joliet, Ills., operated by the Coal Products Manufacturing Company. This plant has a daily capacity of approximately 450 tons of foundry coke and 3,550,000 cubic feet of illuminating gas, and yields, of course, corresponding quantities of tar and ammonium sulphate. The gas is used for illuminating purposes without any enrichment, and is delivered under pressure to a number of towns in the vicinity of Joliet. A battery of 35 combination ovens with by-product plant working on Koppers' patent direct recovery principle for the recovery of tar and ammonia is also under construction at the Corporation gas works, Königsberg, and others are at work or under construction, as follows:

	No. of Ovens.
Duetscher Kaiser Colliery Company, Hamborn.....	126
Friedrich Wilhelmshütte Mülheim Ruhr.....	80
Hösch Iron and Steel Works, Dortmund.....	90
Consolidated Fuchs Colliery Company, Neuweisstein.	30
The Laclede Gas Company, St. Louis.....	56

The whole of these installations also are arranged to work in conjunction with Koppers' direct recovery process.

The Installation of Mains and Pipe Lines of Steel and Wrought Iron.[1]

[Prepared for the Eighth Annual Meeting, American Gas Institute, October, 1913, by H. L. RICE.]

In the choice of pipe for mains and pipe lines the following conditions must be considered:

1. *Suitability.*—Cast iron pipe is not suitable for pressures exceeding 5 pounds, nor for low pressure, in sizes under 4 inches, because of its porosity and the uncertainty of the joints and its brittleness. Screw joint pipe of wrought iron or steel, because of its shorter life, is less suitable than cast iron, where streets are shortly to be paved, and the cost of replacement thus largely increased, or locations where soil and electrolytic conditions are unfavorable.

2. *First Cost of Material.*—Screw joint pipe is frequently cheaper than cast iron in the smaller sizes. Relative price conditions change from year-to-year, and must be closely followed by the careful builder. Below 4 inches the first cost of screw joint pipe will invariably be lowest.

3. *Cost of Installation and Maintenance.*—This may go deeper than cost and include ability to install first class work with cast iron. Small organizations frequently report leakage less, and maintenance easier on screw pipe. The proper decision, estimating the various conditions, resolves then finally in terms of ultimate yearly cost, including depreciation and interest on investment.

Possibly screw pipe may profitably displace cast iron for low pressure work in the following cases:

1. Where pipe smaller than 4 inches is sufficient with reasonable provision for the future.

2. Where the cost of pipe 4 inches or larger is less than that of cast iron.

3. Where in small organizations it can be laid and maintained cheaper, because of the absence of skilled men for laying cast iron pipe.

4. Where special elements of depreciation are anticipated; as where future development of a locality is doubtful, and long life of pipe of less consequence than the low first cost, or when a larger feeder is planned for the future, and the cheapest temporary provision is desired.

Interest and depreciation are of importance as illustrated by an extreme case. Assume the life of cast iron pipe unlimited, and steel pipe 40 years. This is purely arbitrary and expresses no opinion on a subject in which soil and electrolytic conditions are all important. If a 3-inch steel pipe, costing say $315 for 1,000 feet laid, will serve, and a 4-inch pipe, cast iron, costs $425, the money saved by using the 3-inch ($110) will, at 5 per cent. compound interest, amount to $291 in 20 years, $475 in 30 years, or $774 in 40 years, a considerable saving if expectations as to the locality and its gas consumption are reasonably realized, and if the expected life of the main is approximated. Unexpected changes in distribution conditions during the period may make the saving less or more, and other unforseen contingencies, such as pavements, change of grade or location, may cause a material change in the final figures. Naturally, however, determinations can only deal with a reasonable estimate of the future, and variations over any considerable territory will doubtless be found to average. The drift of engineering opinion is toward cast iron, the burden of proof resting upon the pipe of shorter life, and its case may be stated thus:

In high pressure systems, it is the only pipe suitable for pressures above 5 pounds; in low pressure, use will be found for it.

For 2 and 3-inch mains, when these sizes are indicated as proper for permanent need, or for some desired temporary service.

For 4-inch mains, during periods of high priced cast iron pipe, or in organizations not equipped for laying and maintaining cast iron. Seldom for 6-inch under the same conditions.

In the choice of screw pipe, as between wrought iron and steel, the gas engineer meets the same problem as in his service pipe, with the additional qualification that tensile strength is an important consideration in long pipe lines, expansion sleeves at intervals being but a doubtful safeguard. In frozen ground or in soil very hard packed, the strain, even with expansion-sleeve protection, is often very severe. There is a difference in opinion among high pressure engineers as to whether sleeve protection shall be used in screw joint work. The Western United Gas and Electric Company laid 9 miles of 8-inch line (1910) without sleeves. Two breaks occurred the first year; in both the line pulled apart in a valve body, separating 2 inches. The valves and fittings were then protected by sleeves, and one more break followed, this time in a coupling, and two years have since passed without breaks. This breakage was not more than in other lines of this company laid with sleeves. Thus, on 18 miles of 8-inch, laid with expansion sleeves every 800 feet, there have been two breaks by pulling apart, one at a valve and one at a coupling. This company at present is installing sleeves every 1,000 feet, based on the conclusion that, unless used at nearly every joint, sleeves are only partially dependable, and that safety must be sought principally in strength of pipe and fittings; but that their presence in the line at reasonable intervals is convenient for maintenance. The following has been contributed by Mr. E. R. Mason, National Tube Company:

"The relative merits of steel and iron pipe have created much discussion. The average physical properties of the two pipe materials may be taken as follows:

	Pipe Steel.	Wrought Iron Pulled Longitudinally
Tensile strength.....	58,000 lbs. per sq. in.	46,000 lbs. per sq. in.
Elastic limit.....	34,000 lbs. per sq. in.	28,000 lbs. per sq. in.
Elongation.....	22 per cent. in 8 ins.	12 per cent. in 8 ins.
Reduction in area.....	55 per cent.	25 per cent.

"Comparing the chemical properties: Wrought iron has a trace of carbon, while soft pipe steel has approximately 0.07 per cent.; wrought iron has 0.15 per cent. manganese; steel, 0.30 per cent.; wrought iron has about 2 per cent. of oxides and slag, and steel less than 0.15 per cent., showing that pipe designated as 'steel pipe' is of purer iron than so-called 'wrought iron pipe.'" By heating a piece of steel pipe to a bright red, and chilling it suddenly in water and then crushing it, no hardening will be noticed. If it had the characteristics of ordinary steel it would be fractured.

"Butt-welded wrought iron pipe is 70 per cent. as strong as similar butt-welded, steel pipe; and lap-welded wrought iron pipe is 57 per cent. as strong as similar lap-welded steel pipe. There is little difference in the power required to thread the two pipe materials. Improvements in manufacture have removed objections, and the superiority of mild steel pipe in welding, bending and threading is pretty well established.

"*Corrosion.*—The only important difference in opinion is on the question of corrosion. When steel pipe was first introduced there was, of course, lack of direct evidence from service tests and conclusions were formed by many from general observations or from hearsay. Steel pipe lines have now been in use for nearly 20 years,

1. Slightly abridged.—EDS.

so it is reasonable to expect comparative results from service. To form a correct conclusion regarding corrosion, it is important to have a clear conception of what goes on when iron rusts. The fundamental conditions are comparatively simple, involving the presence *together* of free oxygen and water. The chemical or the electrochemical reactions may be divided into two stages: First, solution of a small portion of iron; second, oxidation of this iron to ferric hydroxide or rust. The red oxide thus formed is insoluble, therefore, when precipitated, the way is left clear for more iron to enter into solution and for the further combination of iron with oxygen. These reactions will continue as long as there is oxygen, water and iron left, the absence of either water or free oxygen making corrosion impossible. The *rate* of solution and corrosion is governed principally by the temperature and character of the water, galvanic action between dissimilar materials, electrolysis from stray currents and other minor influences. It is evident then that it is not remarkable that pipe will sometimes last 20 years, while in other places not far away, it will be perforated in a year or so. This has been the experience with wrought iron pipe before steel was thought of, and this has been the experience with both materials since."

Before the American Society of Refrigerating Engineers (St. Louis, 1911), Mr. P. De C. Ball puts his conclusions in the following words:

"It has been found that the rate of corrosion is much more dependent on conditions external to the metal than on variations in the metal itself, and in order to form a correct conclusion it is of prime importance to know whether all the conditions surrounding the pipes were the same.

"Based on several years of investigation, in the laboratory and field, the National Tube Company, 6 years ago, decided to discontinue the manufacture of wrought iron pipe. Ever since steel pipe has been made, lap-welded, wrought iron couplings have been used on it, because of the tendency of steel to gall, and because the tapping machinery was better able to thread the wrought iron—so where local corrosion occurred in pipe lines there was always some of each material present. Further, as steel pipe came more generally into use it was apparently a common accident to make up both materials in the same line. The latter, under internal corrosion, affords the best possible comparison, and fortunately hundreds of such cases have been found without much difficulty. All these investigations have shown that practically no difference exists between wrought iron and steel pipe in general in respect to corrosion."

The writer does not consider it within the scope of this paper to take decided ground upon the question of relative corrosion, and in order that the presentation of the subject may be unprejudiced, an expression from wrought iron interests was invited, which has been contributed by Mr. Ernest A. Moore of A. M. Byers' Company. Further information can be found in a pamphlet issued by the Reading Iron Company entitled "Court of Actual Experience."

"A lengthy discussion has taken place and considerable investigation has been made in attempts to discover the reason for the greater resistance to corrosion shown by wrought iron than steel. It is not my intention to go into a theoretical discussion but rather to point out some facts recognized by observant users of iron and steel. The farmer was annoyed to find that his steel wire fences were rusting out in 5 or 6 years, while older fences of wrought iron were still in service after more than 20 years. His complaints to the Government were so persistent that the Department of Agriculture investigated the matter, and some extracts from their findings will be found in the following:"

"The 'old fashioned' wrought iron, made by the 'puddling' method which yielded most of the extremely durable wire found on the market years ago, contained no steel scrap. But of late years steel scrap has been so plentiful that it has been used in the manufacture of so-called wrought iron, and the unsatisfactory results from this product have done much to complicate a fair comparison of iron and steel."

Regarding the strength of pipe in resisting stresses, due to contraction and expansion and other stresses in service, while steel may show higher tensile strength in simple laboratory test, this is more than offset by the physical qualities of wrought iron, which, being less brittle at low temperatures, will adjust itself to conditions more readily than steel. The value of the pipe in maintaining its initial strength is far more important, and this brings us back to the resistance to corrosion. It is the common experience of those who notice buildings of sheet steel, or roofs, wire, stove pipes or other articles in general use, which were formerly made of wrought iron, that steel does not give anything like the service. These general facts are undeniable, but it is very difficult to condense the evidence to show a scientific proof satisfactory to the chemist or engineer.

Steel manufacturers are producing what is known as Spellerized pipe, claimed to be superior to ordinary steel pipe and equal to wrought iron. The only reliable test of this pipe will be that of service, but on analysis we cannot find that it contains ingredients any different from those in ordinary steel pipe. The resistance to corrosion by wrought iron is largely due to the presence of silicon and the elimination of manganese. It is in these ingredients that the greatest difference occurs between the iron and steel in the following analysis:

	Spellerized Steel Pipe.	Merchants' Steel Pipe.	Genuine Wrought Iron Pipe.
Silicon	Trace.	Trace.	0.178
Manganese.....	0.27	0.20	None.
Sulphur.....	0.032	0.046	0.029
Phosphorus	0.077	0.096	0.126
Carbon.....	0.085	0.062	0.074

On page 18 of "Farmers' Bulletin," No. 239, are following conclusions:

1. That modern Bessemer and open hearth steel rusts much more rapidly than iron wire.
2. That manganese, especially if it is unevenly distributed in the steel, is at least in part the cause of the trouble.

Regarding electrolysis, "Bulletin" No. 30 says:

"* * * It would follow from the electrolytic theory that, in order to have the highest resistance to corrosion, a metal should either be as free as possible from impurities, such as manganese, or should be so homogeneous as not to retain localized positive and negative nodes.

"Assuming, then, equal care in manufacture, wrought iron has the advantage, and in the puddling process, where a charge weighs from 500 to 600 pounds, and is hand worked under the eye of a competent puddler, there is much less chance of it receiving uneven heat treatment and coming out 'patchy,' than in the open hearth process where one charge would be about 20 times as great. The cost of production of wrought iron is governed largely by labor, and while improvements have been made in methods the cost has not been reduced in the same proportion as in the steel process, and we now find a difference of about 30 per cent. in the price of wrought iron and steel. In view of this difference, increasing recognition of wrought iron is in itself proof that genuine wrought iron has proved itself superior to steel in its resistance to corrosion and in its machining qualities."

Coatings and Coverings.—Because steel and wrought iron pipes are more susceptible to corrosion than cast iron, they must depend for maximum efficiency in underground service upon a suitable protective coating. The corrosion may be traced to either (or both) chemical action of the soil, or electrolytic action from stray currents: and the success of the protective agent depends upon its ability to resist the particular conditions to which it is exposed. Mr. Robert B. Harper (Illinois Gas Association, 1909), read a paper on the "Comparative Values of Various Coatings and Coverings for the Prevention of Soil and Electrolytic Corrosion of Iron Pipe." He goes into great detail and cites many valuable tests, and attention is invited to this admirable paper. His conclusion in favor of clean, coal tar pitch, free from water, acids or soluble mineral matter, and his limitation of the value of cloth or paper coverings are especially interesting. Pipe for use within a limited distribution area is usually coated at a central point where heat is available. If the dipping method is used the bath should be hot, the pipe to remain in it until it has acquired the temperature of the bath. When the painting method is used, both the pipe and the paint should be hot. Before coating, the pipe surface must be rubbed or brushed clean of mill scale and rust, and, if rust is heavy, a coat of rust-removing oil should be applied before cleaning. The coated pipe must be carefully piled, the length isolated by vertical and horizontal separating strips. After-handling and transportation demand careful oversight, and the training of the force to the fact that damaged coating is no coating at all. It is in this respect that the additional protection of cloth or paper wrapping is of particular value, and, when soils are unusually bad or electric currents to be feared, this extra protection should be used. In such cases the under coating may be given the additional efficiency of extra thickness and hardness without fearing

brittleness, the wrapper receiving a thinner and more flexible coating. For unusually severe electrolytic conditions, heavily pitching the pipe in a V-shaped trough is good.

Whatever the method of the initial coating, some re-coating is always necessary after the pipe is laid, which must, of course, be done on cold pipe.

Main Laying.—In this connection reference may be made to the paper by Mr. Walton Forstall. It will not be necessary to here repeat the general details and data therein so carefully compiled, but attention will be directed to certain differences in organization, equipment and other details.

With wrought pipe the organization is of much less importance than in cast iron work. Any competent service man or fitter, with sufficient executive ability to direct the larger gang of men, and a little preliminary training in the handling of dirt and pavement, may be trusted with the laying of screw joint mains, the main gang often being only a service gang temporarily enlarged.

Pipe Lines.—The organization for laying a long pipe line is generally of sufficient importance to warrant a special organization and the direct supervision of the engineering department. Special and careful arrangements are necessary for unloading, handling and placing the pipe required, and for coating it. It will be found better to coat the pipe after it has been distributed, and for this purpose a portable boiler is desirable. Such a boiler is moved along the line, heating each length of pipe by steam through a hose; the painting gang follows closely and the pipe, carefully placed on blocks, is usually given two good coats, and is ready for laying as soon as the coating is dry. You must provide transportation, housing and commissary arrangements for men and material, and for communication. A general foreman should be put in charge of the job. Great care should be used in choosing this man, as the work is frequently isolated, and decisions must often be quickly made without reference to supervising officials. This foreman should be experienced in dealing with high pressure gas; a man of tact; able to deal with questions that come up suddenly; and should be a good executive, especially able to handle the foreigner employed on this class of work. He should be provided with some means of reasonably quick transportation, preferably a wagon or motor, capable of making emergency delivery of material.

The men on the work should be divided into plowers, diggers, pipe layers, recoating and testing men, and ditch fillers. The plowing gang will be a foreman on the plow, and a driver for each team of horses, and it is desirable to obtain them from the farmers along the road, thus promoting good feeling. The first furrow is turned with a breaking plow, followed by a special rooter, made with contracted handles for deep plowing, turning the earth to a depth of 2 feet 6 inches. The size of the digging gang will be determined by the nature of the soil and the speed of the pipe gang. These men should have a foreman of their own nationality, and if possible only one race should be employed. Each pipe gang should be in charge of an experienced pipe man, who should be allowed to recruit his gang from the most intelligent of the laborers. Generally some men of experience are found in these gangs to act as helpers, but if not, a fitter must be sent, as there should be at least one good man in each gang to assist the foreman in entering and screwing pipe. For 4 inch pipe, 5 men, in addition to the foreman, compose a good gang; 8 inch pipe will require 12 men, other sizes in proportion. The pipe gang attends to the reversing of couplings, doping joints, and to swabbing out, which is carefully done with each piece of pipe before laying; and also puts on all sleeves, valves and special fittings.

The testing gang may consist of one or more men, according to the speed required, intelligent English speaking laborers. These men turn on the pressure, make the soapsuds test, and mark and report all leaks to the general foreman, who should directly supervise the placing of the leak clamps or the tightening of the joint if that be possible. For filling, a winged plow is used, followed by a road grader, with necessary men and horses.

Digging Machines.—With the perfecting of gasoline-driven digging machines, their possibilities for long stretches of work are becoming interesting to distribution engineers, especially in connection with cross country pipe lines; and particularly because of the growing scarcity of common labor. Where machines can be employed, the plowing and digging gangs are unnecessary, the pipe gang being slightly enlarged, to take care of the small amount of digging required at crossings or any spots necessarily skipped by the machine. The camp to be maintained is much smaller, equipment more limited, and the whole organization becomes more simple. There are certain requirements which a machine must fill before it can be considered at all. First, it must be comparatively light, on account of possible rough roads, and the fact that pipe lines are ordinarily laid between the wagon road and fence line, which often necessitates considerable blocking; second, it must be of narrow beam, so not to block the road, and so it can be worked between the roadway and the fence when the road is highly piked; third, it must operate on a convenient form of fuel, as a large part of pipe line work is in isolated regions; fourth, it must be well constructed, as frequent delays on account of breakage will hold up the pipe laying and soon make the cost higher than hand trenching; fifth, it must have a fairly high rate of speed when working, sufficient to keep ahead of the pipe gang; sixth, it should throw the dirt toward the road, leaving the other side of the ditch free for working. It should be convertible to run on either side of the road, and should throw the dirt close to the ditch, so that back filling will be easy; seventh, it must trench cheaply, the cost per foot to show enough saving to pay interest and depreciation.

A brief description of a machine thought to fill these requirements and now in use under the writer's supervision may be of interest. The machine was purchased this spring at a cost of $5,000 and put to work to dig a stretch of 30 miles. It is of the endless chain, bucket type, driven by a 25-horse power, 4-cylinder gasoline engine. Its dimensions are: Length, 36 feet from end-to-end, when the boom is out of ground; width, 8 feet; height, 12 feet; wheel-base, 13 feet; weight, 27,000 pounds. It cuts a trench 18, 22, 24, or 28 inches wide, and any depth up to 10 feet, at a graduated speed of from 1 to 5 feet per minute, depending upon the width and depth required and the nature of the soil. The traction wheels are multipedal aprons, permitting its being run through very soft ground. It is strongly and simply constructed throughout, the parts receiving the heaviest wear of manganese steel. It has a road speed of 2 to 3 miles per hour and can be easily loaded on a flat car under its own power. The possibilities are shown by the daily reports of work done:

Date, May.	Distance, Feet	Total Cost.	Cost Per Foot.
10	1,450	$11.38	0.0078
11	926	11.80	0.0127
12	1,430	13.38	0.0093
13	560	8.02	0.0143
14	rain.	....	....
15	1,020	9.65	0.0094
16	1,200	11.50	0.0096
17	1,250	11.25	0.009
18	630	9.49	0.0151
19	1,300	13.35	0.0103
20	rain.	....	....
21	rain.	....	....
22	rain.	....	....
23	785	9.03	0.0115
24	1,257	11.51	0.0091

A total of 11,808 feet dug in 11 working days, at a cost of $120.36; or 1,073 feet per day at 1.02 cents per foot. This cost includes the operator and assistant, board bill of the operator, some teaming, gasoline, lubricants and a few minor repairs. It does not include the wages and board of the operator during the rainy days, which bring the cost up to 1.15 cents per foot. This was through a wet, sticky clay, some gravel, with a few rocks, roots of trees, etc., the ditch being 24 inches wide and 4 feet deep. Ground conditions were favorable to the extent that little blocking was required.

Equipment.—For laying 2, 3 and 4-inch, low pressure, screw pipe mains in a town or city, the necessary equipment is as follows:

Four 3 inch bags.
Four 4-inch bags.
Two tunneling bars.
Three tamping bars.
One steel brush.
One bucket, 2 cups.
One laborers' tool cart.
Two rock drills.
One fitters' tool cart.
One No. 2 pipe cutter.
One No. 4 pipe cutter.
One cold chisel.
One chisel bar.
Various fittings, etc.
Two 14-inch bastard files.
One 18 pound sledge.
One machinist's hammer.
Two striking hammers.
200 feet ¾ hose.
Eight red lanterns.
One tape line, 50 foot.
Pipe dope and brush.
Ten shovels.
One tapping machine.
Three Stillson wrenches, 36, 24 and 18-inch.
One 18-inch level.
One oil can.
Ten picks, 3 extra handles.
Ten spades.
One pair chain tongs.
One 12-inch monkey wrench.
One line, 250 feet.
Pipe paint and brushes.
Rope, ¾-inch, 25 feet.
Soap, test can and brush.
Wrench, or lay tong, 3 and 4-inch.
Ten yards wrapping muslin.

For high pressure street main work, the equipment is approximately the same, but gas bags are not needed. The extra fittings should all be high pressure type, and include valves, extra sleeve rubbers, saddles, and high pressure tapping machines and taps. Also add valve keys and tee saddle shut-off plugs.

Trenching and Laying.—For cast iron work 18-inch is a satisfactory width of trench for pipe up to and including 8 inch. For screw pipe the width must be sufficient for the proper handling of the pipe in the ditch, including the recoating, and should preferably be 18 inches for pipe up to and including 3 inch; 20 inches for 4, 22 inches for 6, and 24 inches for 8 inch. Where pipe is screwed on top and afterwards lowered into the ditch, one as narrow as 12 inches may be sufficient.

The usual practice in low pressure city work, 2, 3 and 4 inch, is to joint all the pipe in the ditch and block carefully as in cast iron work. On account of the strength of the pipe stone blocking can be used if it is cheaper or more convenient. The grading must be carefully done and the grade increased slightly for the smaller sizes. All pipe, whether for low or high pressure work, should be ordered with loose couplings, the couplings being in all cases removed and the threads redoped. Each length of pipe should be carefully cleaned, the thread entered with care and the pipe screwed up until it refuses to turn farther. Judgment as to the exact strain or "feel of the joint" can only be gained by experience. It must be borne in mind that the secret of tight joints lies mainly in full union of thread and coupling, and that careful work should practically never show a leak under ordinary gas pressure.

In high pressure work the question of exact grade is not of the same importance as in low pressure. The moisture can be forced along the pipe, and it will usually be entirely removed in the first mile of line, after which grading is of less importance. It is customary to grade pipe lines to avoid unnecessary pockets or low places, but not so careful a grade as necessary in low pressure work; blocking is not used, and the pipe is best allowed to rest upon the solid bottom of the trench. Low places are recorded, but it is not customary to install drips after the first mile or two.

Opinions differ as to the relative advantages of jointing high pressure lines in the ditch or upon the bank, both practices having strong adherents. In wet country the advantage is unquestionably with the outside method, and pipe can be joined and lowered into ditches filled with water, the water acting as a testing medium. For small pipe work in town high pressure distributing systems, the practice is generally to string the pipe on wooden supports over the center of the trench, retouching and lowering at short intervals. Work of this kind is seldom laid to careful grade, and no blocking is used as the presence of moisture is not feared in these areas. Trenches in these cases may be cut very narrow.

High pressure piping is preferably tested with gas at a pressure exceeding the maximum which the line will be called upon to stand. Where town piping is operated at a reduced pressure controlled by a governor, it is frequently possible to by-pass the governor, and test the new mains with the full pipe line pressure. In the case of pipe lines it is not always practicable to obtain the maximum gas pressure for testing, and air pressure may be resorted to; but is less reliable, and some engineers prefer to test with gas at a lower pressure rather than with air at the desired pressure. Pipe lines testing bottle tight at 25 pounds pressure will almost invariably be tight at 50 pounds, and, while testing at half pressure is not desirable, if it can be avoided, it may be reasonably depended upon when necessary. All testing should be done with soapsuds and by careful men, carefully supervised. Pipe lines are generally tested in sections of ½ mile or more between valve stations, and the testing must invariably be done after the pipe is on its bed. The position and character of the leaks will determine whether or not an attempt can be made to take them up in the joint. If the work has been carefully done, leakage can seldom be corrected in the joint, the cause in such cases being the fit of the joint itself. Such leaks can only be corrected by leak clamps, and these carefully applied are secure and reliable. With well made pipe, and good work on the job, the number of leak clamps necessary should not average over 10 to the mile.

In screwing up pipe, care should be taken to injure the coating as little as possible. In the smaller sizes much of the first turning can be done by hand, and in the large sizes the preliminary screwing up can be done with a rope twist. Wrenches and tongs should be applied close to the couplings and moved as little as possible.

At points where pipe lines change direction, not close to a flexible joint, the trench should be widened out at least 1 foot the entire length of the bend. Study of a large number of pipe line breaks shows that the breakage is especially severe during the first year, when the pipe is seeking its final bed, and that large proportions of such adjustment breaks occur at a change of direction in hard soil.

Fittings.—The choice of fittings in low pressure work lies between malleable, cast iron, and fittings of the Dresser type, hereafter referred to as slip fittings. For high pressure work the choice is between extra heavy cast iron, slip-fittings, and, in the smaller sizes, galvanized malleable. The principal objection to ordinary malleable fittings is the threads. Experience shows that cast iron fittings are more trustworthy in this respect, and that pipe laid with these fittings develops less after leakage than with malleable. Cast iron fittings on high pressure work should be extra heavy, as the additional strength is of advantage, and the fittings themselves are more likely to test tight. All fittings installed in high pressure work, except-slip, should be tested as to tightness in the body of the fitting itself before being installed in the line. Care in this will save much after expense. Galvanized malleable fittings may be safely used in high pressure work, 1¼ inch and smaller. Ordinary malleable fittings should never be used, as there is the additional objection of porosity. Slip-fittings have the advantage of easy installation. They are generally well made, without porosity, and provide for expansion and contraction. The disadvantages are in the life of the gaskets, and the difficulty of renewal of these gaskets. A slip tee or cross cannot be slid back, and the renewal of a whole gasket cannot be accomplished, but, in the case of rubber gaskets, a split rubber, with the joint cut on an angle, can be applied. The life of these rubber gaskets is a subject which deserves more study than it has received, although in many cases they suffer practically no deterioration. I recently examined one that had been in for 7 years, and was absolutely perfect, the sleeve lying in dry soil, well drained, at a depth of about 3 feet. Where these gaskets deteriorate rapidly, it can frequently be traced to abrasion due to movements of the pipe within the joint, as in the fittings in proximity to exposed lines, such as bridge lines. In these cases the gaskets wear rapidly, needing frequent and careful attention. There is occasionally failure of the rubber itself, doubtless due in some cases to chemical action of the soil upon the rubber, and where the gas transmitted carries any considerable portion of condensed hydrocarbons, deterioration of gaskets will be accelerated. One manufacturer of slip-fittings makes two types of rubber gaskets, one tipped with duck and the other with lead. These are designed to resist abrasion, and are now under observation, but sufficient time has not elapsed to express an opinion.

Another manufacturer uses an asbestos gasket which is claimed to remain tight and unimpaired under all conditions. Mr. W. I. Battin gives the following account of his experience with these gaskets:

"We have had very little experience with asbestos gaskets, although we started a year ago using nothing but them, both for artificial and natural gas. We did this after getting what information was available, more particularly because where we had trouble with the rubber gaskets being eaten out, we were able to overcome it by putting asbestos in ahead of rubber gaskets. Some of our workmen had also used asbestos in previous years when shy of rubber gaskets, and examination of the old sleeves showed that they held tight.

"In our new work last year we used perhaps 500 8-inch gaskets on artificial gas and 4,000 1¼ inch gaskets with a few other sizes, and while our men think they make up as tight as the rubber gaskets, the length of time has not been sufficient to state their worth in practice, but no leaks have developed as far as I can find where asbestos gaskets were used. I do not know whether they will stand any better than the rubber gaskets where there is a movement of the pipe."

It is suggested that pipe lines find a permanent bed and thereafter do not move at all, and that there must be on these older systems rubber gaskets sufficiently deteriorated that the slightest motion of the pipe will break the surface and start leakage. Under this theory the pipe presumably resists by its tensile strength the strain of contraction, the packed or frozen earth anchoring it at intervals.

A minor disadvantage in the use of slip tees and crosses is the slip feature itself when leaving an opening for future use. Thus where a side outlet is provided, and a short piece of pipe run out and capped, it is necessary in high pressure work to anchor the pipe thus dead-ended, or the high pressure may force it out of the fitting. Slip elbows must be anchored or both joints may be forced out.

Cast iron fittings and valves in high pressure lines should be protected on each side by slip sleeves. Where slip tees and crosses are used, no other slip joints are necessary, except to protect valves.

(*Continued on page* 394.)

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BRIEFLY TOLD.

AN EXPRESSED DISSENT RESPECTING NATIONAL ADVERTISING.—The plan of advertising the many and varied uses of gas and gas appliances, on a scale so comprehensive that it might be termed nation-wide, has been widely discussed, and it has practically progressed to a point which affords opportunity for some determining as to its fair applicability and as to its likelihood of extraordinary usefulness. The Committee of the National Commercial Gas Association, having this matter in charge, gave an excellent resume of its efforts, and while some progress was made, nevertheless the ground so far covered is seemingly neither broad nor long. This is not written in any carping sense, nor is it sought hereby to in any degree cause criticism of those in charge of the plan and scope. To the contrary, the Committee has evidently labored thoughtfully and concertedly over general plan and detail, being confronted at the outset by entrance on a field that was not free from stubble. Again the Committee has the fine common sense to submit that the entire affair is still decidedly in the tentative step, in so far as the eventual outcome is concerned. At the Philadelphia meeting some dissent was made, not to the plan of the procedure of the Committee at all, but rather going much deeper, in fact to the very root of the proposition. A prominent contributor to the discussion in this respect was Mr. Charles M. Cohn, the very much alive Vice President of the Baltimore Consolidated Gas, Electric Light and Power Company. This gentlemen's connection with the N. C. G. A. has been prominent and pronounced; in fact no other member thereof has been more active in its advancing and support than Mr. Cohn, which statement the records will fully attest. Nor may anyone declare that he is not altogether (both from training and experience) capable of appreciating conditions and of fairly analyzing them. Accordingly under the circumstances we are more than pleased to herewith reproduce, with his unqualified assent, his remarks made on the subject during the consideration of this most important question at the Philadelphia meeting:

I should like to discuss national advertising in the capacity of a representative of a company-member rather than from an individual standpoint. It is a matter that vitally concerns company-members in that it calls for direct subscriptions by them to cover the expense of carrying out the proposed plan. The National Advertising Committee has undoubtedly stimulated wide-spread interest in this subject, and the work which it has done reflects great credit upon the men who have unselfishly given their time to the development of the matter. I have, however, never had the pleasure of listening to a full discussion of the various aspects of national advertising, and think this is a propitious time to thresh out in open meeting its various phases, when we can stop, listen to and consider the proposition rather better than in our offices from the printed word which reaches us from the committee. This national advertising plan has been urged upon the gas industry for several years, yet the companies which have so far subscribed to the fund for carrying out the campaign are but 11 per cent. of the available companies in this country, a fact which seems to indicate there is something more than mere hesitation on the part of the companies concerning the advisability and feasibility of the plan as proposed. I say "as proposed" advisedly, because some of its features in my judgment merit the endorsement of the association, and the support of the companies generally; but there are other features which should be fully, freely and frankly discussed before the association is furnished with funds with which to carry them out. I refer particularly to the general plan of the National Commercial Gas Association directly advertising through the media of magazines and trade papers. I have only words of commendation for that portion of the propaganda which involves the publication of booklets, etc., and seasonable newspaper copy, and the furnishing of expert advertising advice by an advertising bureau of the association. This subject of national advertising was first brought to my attention at the Denver Convention (1911), through the report of the National Advertising Committee, and, as I recall it, the committee cited the marked success of the National Biscuit Company as an instance of the success that could be obtained from a national advertising campaign. I did not then, nor do I think now, that that example is at all apropos of the situation in the gas industry; and since that time I have not seen cited any instance of national advertising which really supported the claims that local gas companies would benefit by the placing of advertisements in national magazines and journals. In the first place, I want it clearly understood that I am not in any way opposed to the association following the usual course of giving assistance to company-members in their regular work of supplying gas satistactorily to their respective communities. The particular feature of the proposed plan which I oppose is that this Association should undertake to deal directly with gas consumers, by placing in national magazines advertisements which emanate from the headquarters of the Association. I do not believe it within its legitimate province to actively and directly participate in the work which distinctly belongs to the gas companies in their respective communities. If it were proposed that the Association prepare advertising matter for the various gas companies and place it at their disposal, as well as giving them, fully and freely, expert advice on advertising, I would be in hearty accord with the plan; but I do not think the Association should undertake to carry on work directly in the communities in which gas companies themselves are engaged, whether this work be advertising or any other branch of commercial work; or, in fact, any sort of work that affects or interferes with the local relations between companies and consumers. The idea of the Association undertaking to handle advertising matter directly from a central headquarters is a radical departure from anything which has been done, and I should like to focus your attention upon this aspect of the national advertising plan proposed by the Committee. We are told by those favoring national advertising in its broadest sense that there are well known examples of its advantages. The illustrations furnished us fall into two classes: First, manufacturing concerns that sell their products nationally, such as the National Biscuit Company and manufacturers of electrical equipment. It ought not to be necessary, it seems, to call your attention to the fact that these industries can furnish no illustration applicable to the gas industry. The business done by them is not distinctly local, but is national in its scope; the second class referred to is public utilities, and the American Telephone and Telegraph Company is cited as furnishing a striking example. The universality of telephone service by this company puts it in an altogether different class from that of an individual gas company supplying only its own community. The telephone situation is unique, and the extension of telephone service over a large portion of this country, so often graphically illustrated in the advertisements appearing in national magazines, may, unfortunately, in time prove very disadvantageous to this company. Every example of national advertising which has so far been cited in support of national advertising by gas companies deals with industries that either sell their product nationally or whose service is furnished over a large area of country. Gas companies operate locally, which constitutes an essential difference, and I have never heard this distinction referred to or discussed by those who have urged national advertising for the gas industry. It would be interest-

ing to have the views of the National Advertising Committee on this very important phase of national advertising by the gas industry. What are some of the arguments which might be advanced against the specific point of having advertising matter emanate directly from the central headquarters of the Association, and there controlled and placed in magazines circulating nationally? I happened to have considered, as a member of the Board of Directors last year, the propositions submitted by various leading advertising agencies for carrying out the plan. It might be pertinent to say here that the advertising report submitted at Denver was referred to the incoming Board of Directors; and Mr. Holman, the newly-elected President, with his usual conservatism (he might be said to be a conservative-progressive, judging from the results he has obtained at St. Louis), took the position that the Association would not plunge into the proposed national advertising movement unless it could be demonstrated as a safe and practical working plan. At a subsequent meeting of the Board of Directors held in New York, a whole day was devoted to hearing representatives of leading advertising agencies who submitted their arguments and plans. It was the judgment of the majority of the Board, after hearing all that was said, that no plan of national advertising had been submitted which they thought was advisable and sufficiently definite to justify approval. Now, just take one objection that these advertising experts could not overcome. Practically all of the specimen advertisements submitted were in form anonymous; in other words, they did not show their source or origin. We hear a great deal from advertising and publicity men regarding the "human element," which vitalizes and gives force to advertising and publicity work of all kinds; and yet we now hear them advocating this phonographic method of addressing the public. The value of personality in advertising is clearly shown in the advertisements appearing in the New York city papers containing the name of the distinguished President of the local gas company. It is true various expedients were suggested for overcoming this difficulty; but none of them was considered practicable. And I have yet to hear a suggestion which would make advertisements coming from the central headquarters of this Association appeal to a particular individual, in a particular community, so that he would understand that the advertisement, and what it stated, were intended for him and as expressions applicable to his own gas company, its views and its policies. That bridge has never been crossed. As I have said, conducting a gas business is essentially a local proposition, and the gas consumer, who reads an advertisement concerning the gas industry, would not be interested unless he thought it was applicable to him, his condition and his company. The placing of anonymous advertising, in such a case, is a waste of money. One of the means suggested for meeting this difficulty was the use of the name of the National Commercial Gas Association, explaining it was composed of progressive gas companies throughout the country, which suggestion is fraught with considerable danger as will be seen. Assuming that the plan of advertising in national magazines might be considered workable, and that the objections so far considered have been overcome, we must not lose sight of the effect on the public mind of the gas companies of the country acting in a manner which would indicate a community of interest between them, a condition of affairs which would be seriously objectionable to the American people. One reason that gas, and other similar associations, have been considered agencies for good, and given popular endorsement, has been that their activities are chiefly directed towards the betterment of the gas service generally; but when it becomes apparent there is a movement to enlarge earning capacity rather than to increase efficiency and better the service, just so soon will associations such as ours lay themselves open to serious public criticism, whether it be just and well founded or not. A minor consideration to which I was early going to allude, is the practical suggestion, which always occurs to gas managers, of getting a proper return for a dollar expended, and this is true in advertising as in all other expenditures. I am in no way convinced that the same amount of money which gas companies are asked to subscribe to carry on national advertising, if applied locally, would not be far more productive. Personally I believe it would be more productive, and that the returns could be greatly enhanced by the aid and assistance this Association could give gas companies in their local advertising work. It is no answer to say that the amount of subscription asked for is in addition to the ordinary and usual advestising appropriations of gas companies, for I venture to say that the vast majority of new business managers, if given freely their choice of applying additional advertising appropriations, would elect to use them locally rather than nationally. If good results are now obtained from local advertising, additional funds could with advantage be applied locally Were we in executive session I could give further reasons why it is inadvisable for this Association to launch the plan of national advertising to the extent proposed by the Committee. I will, however, confine myself to a few words on the latest endeavor of the Committee to place its plan in a favorable light. I refer to the paper just read from the Chairman of the Executive Committee of the British Commercial Gas Association, Conditions in England (especially political conditions) are altogether different from those of this country. In England there is only one parliament, whereas we have 48 parliaments, and one. There may be many factors which would make national advertising desirable in England, which, even if known and understood by us, would not be controlling here. I am not satisfied, from anything I have heard from a disinterested source, that the plan of national advertising is successfully and satisfactorily conducted in England; but whether it is or not, we must consider our own conditions, and satisfy ourselves that such a plan is advisable under the conditions which obtain in this country. We have also been urged, in this convention, to act promptly in subscribing to the national advertising plan because of the apparently successful efforts recently made in the electrical industry for a similar plan. It should be understood that the leading electrical association of this country has not placed the stamp of its disapproval on national advertising, and the plan which is now being promoted has not the sanction of that Association; but is, I understand, being urged and supported largely by the manufacturing interests in the electrical industry. My principal purpose in discussing national advertising at this time is that we may get an expression of opinion from the leading men of the gas industry (whether at this meeting or not) who may not be in accord with the plan as proposed. I also have in mind that it would be well for you when you return to your respective companies, to give consideration to the dissenting views which I have expressed to-day, so that we can have intelligent action in the matter after a careful consideration of the material arguments and facts on both sides of this important question.

Injunction Denied, Fargo, N. D.—Judge Pollock, District Court, Fargo, N. D., on the 12th inst., handed down his decision in the case of the injunction proceedings, instituted against the Union Light, Heat and Power Company, of that city, by certain residents who sought to restrain the Company from reconstructing its gas plant on the present site thereof. It was alleged that the plant was a nuisance, and as such should be removed elsewhere. The hearing was a lengthy one and much interestimg testimony was given during its continuance. The judge remarked, in an opinion dismissing the plea: "Many of the annoyances claimed to have existed in the past have been wholly removed; the most modern methods for the manufacture of gas have been and will be employed; the odors arising, as far as ammonia and tar smells are concerned, are thoroughly safeguarded—at least for the future—and the plant as now perfected emits the least possible odor. It is unthinkable that, in this modern day, where so many people use gas for fuel and illuminating purposes in this city, that the whole city of Fargo should be discommoded and deprived of its privilege to use this kind of fuel, simply to protect a few persons who, of their own choice settled near this plant; or that the defendant, which has been investing its money to so large an extent upon the faith of the power vested by the Legislature in the city of Fargo to grant the franchise which it did to carry on a lawful business, should be suddenly deprived of its property or so disturbed in its enjoyment that the necessary result would be to cast upon the citizens of the city generally large expense to either buy a plant of their own, or submit to excessive charges made necessary by so great a loss upon the part of the present Company."

December Meeting, New England Section, N. C. G. A.—It is certain that a very interesting meeting of the named body will be brought off in Wesleyan Hall, 36 Bromfield street, Boston, the evening of Friday next. Mr. Elmer S. Stack, Manager, the Somerville Manufacturing Company, slated as the speaker of the evening, is down for an instructive response to the question, "What Are Water Heaters?" Mr. Stack, who has had long experience with apparatus of this sort, will have his text punctuated with many stereopticon pictures of construction work, showing the right way and the wrong one in respect of installing the apparatus. It is also promised that an interesting recount of the happenings at the recent Philadelphia meeting of N. C. G. A. will be presented by "Some who were there." A fitting sequel will be the live programme of entertainment arranged by the standing committee in charge of such affairs.

CURRENT MENTION.—

The Municipal Council, Paris, France, after an exhaustive investigation of the matter, has, by a vote of 43 in favor to 32 opposed, sanctioned the manufacture of water gas, to supplement the manufacture of coal gas. The sendout will eventually comprise a mixture of 50 per cent. of each type of gas. Of course, we take it for granted that the Paris gas plants are mainly operated on municipal account.

The Paxton (Ills.) Gas Company announces an increase of $15,200 in its capital stock, which will thus total at $55,200. The Company is quite prosperous.

Mr. Paul Leake, Publicity Manager of the American Public Utilities Company, informs us that the Directors of this cleverly managed corporation, at a meeting held the 11th inst., decided to increase the dividend on its common stock to a 3 per cent. per annum basis. All of which goes to show that the Kelsey-Brewer-Gavett concern is more than redeeming the promises made to original investors in the Company's securities.

Mr. John A. Cleveland, General Manager of the Saginaw-Bay City (Mich.) gas, electric light and traction interests, has been appointed to a responsible position in the home offices (14 Wall street) of Messrs. Hodenpyl, Hardy & Co. He comes here January first.

"B. S.," writing from Hartford, Ind., under date of the 12th inst., says: "We are sorry that Mr. William Morris, heretofore Manager of the office in Hartford of the Central Indiana Gas Company, has resigned. He leaves for Oakland, Cal., the 20th inst., where, with his estimable wife, he proposes to make his future residing place."

(*Continued from page* 391.)

In high pressure town work galvanized malleable fittings may be safely used under 2-inch, as they are generally found satisfactory as to strength and tightness.

For closing-in gaps, or cutting-in fittings, slip sleeves are of great convenience. The only objection to them is the question of the gaskets, and this becomes of special importance in work under paving. The only alternatives are cast iron sleeves, with lead or cement joints, and, in sizes 2 inches and under, long sleeves, ground joint or lead gasket unions, etc. Of these union fittings the so-called grip pipe couplings are worthy of consideration. While it is doubtless desirable to minimize the number of slip fittings under pavement, experience with these fittings has been too generally favorable to warrant any serious apprehension as to their use under pavement when otherwise desirable. The following is good practice:

Low pressure city and town systems: Fittings at intersections, cast iron screw fittings, ordinary weight. One slip sleeve for each block 400 feet and under; 2 sleeves for longer blocks; locations carefully marked.

High pressure town work: Extra heavy cast iron or slip fittings at intersections. Galvanized malleable may be used under 2-inch. All valves must have one slip joint in close proximity.

Pipe line work: For elbows, the pipe to be bent wherever possible. When necessary to use a fitting, extra heavy cast iron. Slip joint ells not desirable, as they require bracing. For tees and crosses, slip fittings preferable, except where openings are dead ended. All cast iron fittings and all valves to have slip sleeves on each side. Other slip sleeves to be installed at intervals, but should not be depended upon to relieve strain, unless as close as 200 feet apart.

Valves.—Valves should be inserted in pipe lines in order that any portion of the line may be closed off quickly. General practice is to place them at ½-mile intervals. All-iron valves should be used. The value of a valve is often seriously impaired by foreign matter under the gate. Mill scale or other foreign matter from the interior of the pipe may become loosened and lodged in the pocket of the valve.

Pipe line valves should have a plugged hole at the bottom for cleaning the pocket under the gates, and where so provided, any accumulated dust or scale can be blown out. In view of the difficulty of maintaining a completely tight system of valves, one large, high pressure, system has changed from single valves ½ mile apart, to double valves 1 mile apart, the double valve being 2 valves about 10 feet apart with a vent between.

In high pressure distributing systems valves should be placed at intersections and should be sufficiently frequent in the system that repair work may be undertaken without shutting off many customers at once. Gate valves should be used down to and including 1¼-inch pipe, globe valves on the smaller sizes if preferred. Gate valves should have cleaning holes at the bottom. Plug cocks may be used for 1-inch mains; but in the larger sizes trouble may be experienced unless a very good design of cock is used.

To be depended upon for the quick stoppage of leakage, valves must be found and used without delay. In seasons of snow they must be kept cleared, covers must be free from ice, and the interior of the boxes clear at all times. It is better to have a few valves in boxes properly maintained than a large number of doubtful security. Dead ends are of no disadvantage in high pressure systems, and it is, therefore, possible to divide it up into areas of reasonable size controlled by a master valve.

The design of all high pressure systems should be such that gas can be quickly and surely shut off at need.

Depth of Mains.—Gas will always suffer deterioration in compressing and after cooling to ground temperature, greater than if the gas were not compressed. But it does not follow that further deterioration will not ensue when the gas is further cooled. The hydrocarbon vapors the gas will retain will decrease as the pressure increases at constant temperature, or as the temperature decreases at constant pressure. High pressure lines should, therefore, receive the same covering as low pressure lines, and all exposed places, such as bridge crossings, should be protected.

Service Tapping.—For 1 or 1¼-inch services, a 2-inch, low pressure wrought main should be drilled ¼ inch, and a saddle applied, tapped ¼-inch. For larger services the main should be cut and tee inserted. For 1, 1¼ and 1½-inch services, from a 3 inch main, drill ¼-inch and use saddle tapped ¼ or 1 inch. For 2-inch or larger, the main should be cut and tee inserted. For 1 to 1¼-inch services from 4-inch main, a ¼-inch hole should be tapped, and no saddle is required. For 1½-inch services a 1-inch hole may be drilled, and saddle tapped 1 inch used. For larger services the main should be cut and tee inserted. For inserting bags ¼-inch holes should be tapped for 3-inch and 1 inch for 4 inch bags. All high pressure mains larger than 1 inch should be drilled ¼-inch and a tee saddle applied. For service connections from inch high pressure mains, galvanized tees should be inserted.

While not best high pressure practice, small mains may be safely connected to larger mains by saddles. Inch mains may be taken out of 3-inch or larger, tapping ¼-inch hole and other sizes in proportion; the connection should be on the side of the large main and a slip sleeve installed in the small main close to the connection.

Removal of Moisture.—Condensation should be removed from high pressure gas as soon as possible after the gas reaches ground temperature. This is most conveniently done by employing a series of baffle plates on the principle of a steam separator. If the line itself is used as the condenser, the baffles should be at low points in the first 2 miles of the line. The base of some steep hill is an especially favorable point. If the gas is cooled at the pumping station, baffle tanks at that point will remove the greater part of the moisture. The line up to the last baffle should be laid below frost line, as there is danger of ice before removal of the moisture, which danger is especially great on up grades where the moisture flows slowly back against the flow of the gas. Bridge lines close to pumping stations must be watched with especial care, but under some conditions such exposed lines may be left uncovered and used as condensers. When ice films form during extreme cold weather, and a warmer period sets in, the films form slush in the pipe, which may jam at some point difficult of access and completely stop the flow of the gas. The safest method of using the line as a condenser is that of bringing the gas gradually to ground temperature below frost level, then removing the moisture. There is little danger beyond this point, even if the pipe is later exposed to low temperatures, for, as the pressure falls, the moisture capacity of the gas is increased, and its moisture capacity at a lower temperature may be practically the same at the lower pressure as at the original pressure and temperature. It is, of course, possible to cause an additional deposit of water in any high pressure system by extreme exposure.

Governors.—Where two or more towns are supplied from one pipe line, it is best practice to place a reducing governor at the entrance to each town, making the distributing system pressure independent of the pipe line pressure. The pipe line pressure may vary widely between peak load and light load, and the town distributing system not necessarily vary to exceed 3 to 5 pounds. In most cases governors set to furnish 10 to 15 pounds will give an ample margin of supply. Operation within a limit of 1 pound is entirely satisfactory, and may be depended upon. The governors should be located in well-constructed pits and provided with by-passes.

Extra Large Steel Mains.—Beginning with 8 inch, steel pipe is manufactured in more than one weight; and, in the larger sizes, there is much choice in this respect for the pipe line builder. In addition to what is known as pipe, there are tubing and casing in which the thickness and weight are reduced, and much large pipe lighter than standard weight is safe to lay with screw joints. From 10 inches up, however, practice favors plain end pipe, with couplings of the Dresser type. This construction is generally cheaper and safer in large diameter pipe work, and must, of course, be used with the lighter weights of tubing or casing. There are also special joints on the market of which the Matheson may be mentioned as typical.

For extended experience along these lines we must go to natural gas practice, and the following observations by Messrs. Battin and Wishart are of interest:

"The tendency nowadays in high pressure natural gas work is to use light pipe and long lengths. The last 10-inch pipe we laid (110 miles) was only 28-pound pipe, and the lengths averaged 28 feet. What is often used is the same as lap-welded casing, which in 10-inch outside diameter weighs only 21.9 pounds per foot. Natural gas companies often use this casing on 3 and 4-inch lines. Even boiler tubes are used for such lines. One of the reasons for using thin pipe for natural gas is that it is generally expected to be temporary and lines are put in for a comparatively short expected life.

Where the pressure is high enough to make it desirable to use something heavier than standard lap-welded casing, heavier tubing, but lighter than the standard pipe, can be had, which in 10-inch weighs 32 pounds per foot, but which is also made in 35 and 40-pound weights. Even in the case of the heavier pipe, it is cheaper to use couplers than

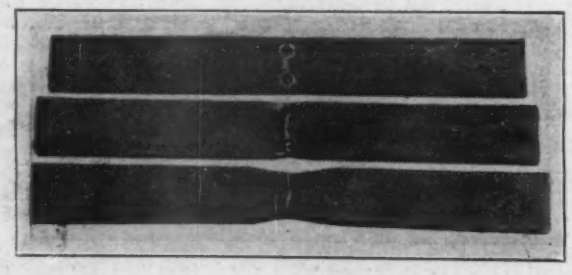
to use screw pipe, and there are fewer leaks at the start, the pipe remains tighter, and there are practically no cases of pulling apart from expansion and contraction. These lines seldom have more than a foot or so of covering, unless the pressure is such that they have to be weighted down to prevent them raising out of the ditch, and hence frost surrounds the pipe every winter. Under such conditions screwed pipe would break in many places. For artificial high pressure lines we would not care to use these very light pipes, although we would not use a screwed coupling in any case for large sizes. Comparing the Matheson joint with Dresser or similar couplers, we note it takes only half the number of gaskets. Even this is not used in most cases, because Matheson joints are generally lead caulked, but the result is the same as with cast iron pipe; they do not remain tight, no matter how many times you recaulk them. Where a reinforcing gasket is used, the Matheson joint is tight at the start and remains tight. Our experience rather favors the use of coupler pipe or Matheson joints, instead of screw joints on pipe 6 inches or larger."

In conclusion the writer desires to make acknowledgment of the valuable assistance he has received from his business associates. Adequate presentation of so comprehensive a subject has been found difficult within the limits prescribed, but it is hoped that discussion will be stimulated and serve to amplify and improve the various details suggested.

Punched Holes in Structural Steel.

In "Le Genie Civil," C. Birault, chief of the department of testing materials of l'Ecole Centrale, Paris, discusses the effect on the elastic limit and tensile strength, of drilled and punched holes in mild steel, such as is usually employed in building construction. He claims to have established that the resistance to rupture of solid bars, and perforated bars of the same metal, is not proportional to the section of the bars, making proper allowance for the perforations. Section for section, the advantage is in favor of the perforated bars if the holes have been drilled. The holes weaken the steel much less than would be expected, provided care is taken in drilling the holes, and in reaming them after they have been punched; and the elastic limit and the resistance to breaking are higher than before drilling.

Three bars were cut from one piece of steel. One bar was pulled in its original condition; the second bar was perforated with two drilled holes located on the small axis of the bar, and the third bar was perforated similarly, except that the holes were punched. The holes in each case were of 15 mm. diameter, and spaced three diameters from center to center. Several series of tests were made. The illustration shows a set of the three bars from the same steel, the



Effect of Drilled and Punched Holes.

fractured ends placed in contact. The plain bar has elongated more than the other two, since the molecular fatigue is less than in the perforated bars. The bar with the drilled holes (the middle one) has elongated further than the one with the punched holes, and the holes have become decidedly oval, which is not true of the punched holes. Comparison of the two perforated bars shows how the drilling or punching modifies the properties of resistance. The fracture of the punched bar is not along the diameter of the holes, probably due to fissures in the metal caused by the action of the punch. The bar with drilled holes parted on their center line. The numerical results also support the evidence in favor of drilled holes. The results of three sets of tests are as follows:

Set from first bar—	Elastic Limit, Kg.	Tensile Strength, Kg.
Plain bar	24.4	39.2
Bar with drilled holes	31.4	43.5
Bar with punched holes	33.4	37.6
Set from second bar—		
Plain bar	23.4	37.9
Bar with drilled holes	29.3	43.3
Bar with punched holes	31.3	36.5
Set from third bar—		
Plain bar	25.7	46.1
Bar with drilled holes	29.4	49.4
Bar with punched holes	34.4	34.8

It will be noted that the elastic limit is higher for the bars having perforations than for the plain bars, with an increase for the punched holes over the drilled; while in tensile strength there is an increase for the bar with drilled holes, over the plain bars, the bars with punched holes losing decidedly in strength as compared with the plain. Averaging the results in terms of percentage, the bars with drilled holes have 12.3 per cent. greater average elastic limit, and 9.2 per cent. greater average tensile strength than plain bars of the same steel; while the punched bars show an average increase of 13.5 per cent. in elastic limit and an average decrease of 8 per cent. in tensile strength, as compared with plain bars of the same steel.

The author finds upon bringing into contact the fractured ends of the plain bar, that the two parts are not complementary; that there is a hollow space near the center where the metal has evidently drawn away first, the break then proceeding gradually to the two sides. If, however, the metal is perforated with smooth drilled holes, not having fissures as in punched ones, this tendency of the metal to separate and weaken is removed, and the mean resistence to rupture is more uniform.

These tests show that insistence cannot be too strong on the practical importance of reaming punched holes in mild steel, a practice too often neglected for economical reasons.

How to Establish a More Intimate Relation between Departments in the Administration of the Gas Business.

[Prepared by Mr. R. C. Ware, for Eighth Meeting, American Gas Institute.]

In submitting this paper, the writer wishes to acknowledge his indebtedness to the following gentlemen who have most heartily and freely given of their experience:

Person.	Occupation.
Cowdery, E. G.	V.-Pres. Peoples G. L. & C. Co., Chicago.
Liggett, L. K.	Pres. United Drug Co.
Pearson, Prof. H. G.	Mass. Inst. Tech.
Stannard, C. N.	Secy. Denver G. & E. Co.
Whitton, W. H.	Secy. Laclede Gas Light Co.
Young, P. S.	Comp. Pub. Ser. Corp., New Jersey.

Co-operation is the keystone of social under taking. Great is efficiency, but efficiency without co-operation is impossible.

Esprit de corps—admirable; but, unless put into effect, it is only a mere state of mind. The most notable departmental achievements, unless the results are made permanent through inter-departmental co-operation, are of little value and, failing the necessary permanency, may even prove hurtful. Efficiency in management is based on constant attention and unswerving loyalty throughout the organization, staff, rank and file—loyalty which can only be founded on absolute trust in, and respect for, the executive. Without complete mutual confidence, harmonious operation is impossible, and without harmonious operation disintegration is almost inevitable. This is true in the major departments and through the sub-departments. Much more is necessary than mere unquestioning obedience—the intelligent *will* to act for the best interests of the department, of the company, and of the public served, is all important.

Granting, the necessity of close and closer inter-relation between departments, as between individuals, how shall this best be secured and improved? The subject naturally falls into sub-heads:

I. Basic Organization.
II. Departmental Work.
III. Inter-departmental Committee Work.
IV. Inter-departmental Training.
V. Inter-departmental Promotion.
VI. Association Meetings.
VII. Training School.
VIII. Social Functions.

IX. Profit Sharing.
X. The Non Co-operator.
XI. Miscellaneous.
XII. The Executive.

I. *Basic Organization.*—(a) We cannot do better than consider the letter of Mr. Liggett, thus: "The principle of co operation is positive sincerity in individual action well directed in a composite plan, and can only be obtained by elimination of friction, which elimination seems to create a vacuum that is immediately filled by a spirit of co-operation. * * * The way to eliminate friction is to specifically define authority and duties, so there is no doubt about individual responsibility. It is a difficult thing * * * to fit men into positions and to prevent confusion and overlapping of duties * * * not because of the desire of any individual to interfere with the work of others, but because of over-zealousness, and not realizing the point at which his activities interfere with the work of another. This led me to diagram our business without reference to individuals, and to definitely set up by blue print a picture of the business, showing its divisions, from stockholders down. * * * This done, I put a man in charge of each major department, for which he is solely responsible, and by following the lines of the chart cannot possibly mistake the points at which his authority begins and ends. He in turn puts a person in charge of each of the sub-divided parts of his department and this responsibility is likewise fixed. The heads of these major departments constitute my cabinet. Inter-departmental matters are threshed in cabinet meetings, policies determined and plans devised; and each man puts in motion the things needed to be done by his specific department in pursuance of any plan agreed upon. This makes co-operation compulsory, since no one department can very well be eliminated from a general plan, therefore, the obligation is upon each to be ready with its part. Delinquency, inefficiency, unnecessary delay or unpreparedness will be quickly observed and complained of by the departments being held up. The result is a friendly rivalry, and loyalty to the cause that is not often equalled."

The W. H. McElwain Company, one of the most prominent shoe manufacturing establishments of the country, attributes a large part of its success to the establishment of definite half-days' stints by each department. The work, carefully planned, is passed on a "railroad schedule" from department to department, the instructions being that work shall leave each department at the time set, whether finished or not—neither sooner nor later—so that the department following it may not be held up. In this manner unpreparedness or inefficiency in any department is brought to light at once and corrected promptly with minimum interruption to operation. The schedule is followed out from beginning to end, and work which comes through faulty or incomplete is cared for afterwards. This eliminates in large part inter-depar.mental friction and has brought about a high state of efficiency.

In a business as thoroughly systematized as the gas industry, this ground in the general organization has been adequately covered, but it is well to bear the points outlined in mind when laying out new work or organizing a new sub department. Hence, also, the necessity for a periodic survey by department heads, to prevent blurring of the lines of demarcation. The organization chart is a feature far too little used, and its absence is undoubtedly responsible for many failures of co-operation through ignorance of the employee of the structure surrounding and including his immediate department.

(b) So build and conduct the business that the employee will have absolute confidence in the company and in all its dealings. Modern business has progressed beyond the point where it was considered justifiable to do things in business transactions that a man would not countenanee in his personal affairs. No employee should be asked to do, in the name of the company, anything that he would be unwilling to do in his own name. He should, on the contrary, be made to understand that the company will countenance no distinction between public and private morals.

This applies to the individual and to departments, as it is important that no department be required to act other than in accordance with the code required of the individual. Not infrequently one hears this remark, "I like my work all right; but I wouldn't want to have to do what the fellows in that department are expected to do," referring not to the work itself but to the moral aspect. True co-operation, spontaneous and hearty *esprit de corps* and healthy development can only exist, endure and increase when the business has a conscience.

II. *Departmental Work.*—A man may feel no affection for his superior, but, having confidence in him and respecting him, will prove an efficient employee and a good co-operator. If he distrust his superior, the usefulness of one or both is seriously impaired. Hence the necessity for resistance on the maintenance of a high character standard throughout the organization. The company may well hold that while it is not supposed to exercise control during any but working hours, it has a right to expect and to require that the conduct of every employee on or off duty shall not be such as to impair his usefulness and efficiency.

Assuming, then, mutual respect throughout the department, the next step would seem to be a systematic planning by which employees of similar grades should be familiarized with the work of their fellow employees, and with that of the employees in the grades immediately above and below. This, however, is not enough, for any one department has dealings with other departments through these persons. It would seem profitable, therefore, to have clerks responsible for interdepartmental communication meet one another. It is often an eye-opener to find that the person who, in your daily talks over the telephone, seems gruff and uncompromising, is really most agreeable and human. Such little touches oil the bearings of the mechanism and promote interchange of ideas and short cuts that prove of great value.

Periodic meetings of sub-department heads and chief clerks are of value, as matters may be taken up which otherwise may never receive full discussion, through lack of opportunity. At these meetings the department head should be present, to gather information and to promulgate orders of general application. In this manner much delay and misunderstanding may be avoided.

III. *Inter-Departmental Committee Work.*—In some companies inter-departmental committees have proved very useful, the committee dealing with one department having for its chairman the head of that department and for advisory members the heads of departments affected by its work. Thus, the Committee on Distribution Department Affairs would have for chairman the engineer of distribution and, as advisory members, the heads of the manufacturing, accounting, new business, bookkeeping and collection departments.

The Committee on New Business would have as chairman the head of the new business department, with the heads of the distribution, accounting, bookkeeping and collection departments as advisers.

It is not the intention that the committees should *control* the activities of the departments concerned. The control is vested in the head of the department, who, acting as chairman of the committee, profits by the discussion, advice and information brought out in committee meetings, and bases upon these his judgment and actions. In such committee work it is important that matters should not in general proceed to a formal decision upon lines of conduct, for should this decision be contrary to the wishes of the head of the department he would not unnaturally feel he was being constrained against his better judgment; and should he, on the other hand, act without regard to such decision the rest of the committee would feel that the committee work was a waste of time. It is, however, highly important that department heads should be acquainted with the programmes of other departments by which they may be affected, and it is of great assistance to the head of a department to be advised in advance what effect his actions will have upon the departments which interlock with his.

It has been suggested that a grievance committee might probably be appointed, to consider matters in dispute between departments, and to investigate any appearance of friction. While the name is perhaps harsh, and the idea of a real grievance between departments hard to tolerate, the existence of such a committee might tend to expedite the smoothing-out processes which are constantly underway; for undoubtedly much is now passed over as not worth troubling about merely because there is no particular person or body whose function it is to receive complaints.

Inter-departmental committees should make it one of their prime functions to check unjust criticism among departments, and to eliminate any criticism *to the customer* of any other department. These committees should use every effort, both as organized bodies and as individuals, to impress upon employees that their ultimate success, as well as that of the company, depends upon perfect harmony between all departments.

IV. *Inter-Departmental Training.*—This has been comparatively little tried, but the results where put into operation have proved satisfactory. It would not be practicable to have any large number of employees schooled in more than their own work, but it may well prove profitable to take a certain number of picked beginners at regular intervals and put them through a systematic course of training, which will carry them through most or all of the departments. The result cannot but be a closer knitting together of the entire fabric. There is an added advantage in that after thus trying them out in the different departments, the men may be put in the best place fitted for them. It is further believed that any organization would materially benefit by having the heads of departments leave their own work for a time, devoting the time to the work of other departments.

Another plan, yet to be tried out, but which has distinct possibilities, is the organization of a "flying squad," consisting of supernumeraries under control of a superintendent or chief clerk, to be called upon by any department which happens to be in need of assistance. Thus, during the moving season, it would furnish extra clerks to the application department. During the late autumn and late spring these clerks would serve as additional salesmen in the salesrooms. During special advertising campaigns they would assist in getting out the advertising matter. In case of unexpected demands they could be utilized as outside salesmen. They could be of considerable assistance in the auditing department, when closing the books each month, and to the bookkeeping department when ledgers were to be transferred or analyses of accounts struck off. In the vacation period their usefulness is evident, and the inefficiency which always results from engaging substitute workers would be largely eliminated. In a similar way the engineering wing of the "flying squad" would be valuable during the season of heavy output, on distribution work or in the manufacturing end, as circumstances might require. In the summer time the increase in main and service work would find them available. From the ranks of this "flying squad" could be picked the men for permanent positions from time-to-time.

V. *Inter-Departmental Promotion.*—This is a difficult subject over which to make any programme for an employee who is particularly

efficient, as a jobber may be perfectly hopeless in other departments, or an admirable collector may make a very poor salesman. An orderly and regular progress from one department to another is, in general, out of the question. It is further only fitting that the careful training given a man by one department should be of benefit to that department as long as is reasonably possible. Exceptional cases, however, should be provided for, and where a man shows marked adaptability or efficiency his promotion might profitably be into some other department. This would result in tying together the branches of the organization, for the promoted member not only brings with him the knowledge acquired from the department he is leaving, but also brings its goodwill, naturally taking pride in helping him to success in his new department. The procedure tends also to create a desire on the part of the more versatile employees to fit themselves for better positions in other departments. The natural trend of promotion in this manner would seem to be towards the commercial or new business department, where versatility and initiative are at a premium, and where knowledge acquired in the other departments is of particular value.

VI. *Association Meetings.*—National conventions are not referred to, though the companionship of the heads of departments in attendance from any one company is undoubtedly of great value to their organization. The meetings of more vital importance as regards departmental relations, are those of local and company sections of national associations, efficiency clubs, service clubs, etc. Such gatherings are primarily useful for disseminating knowledge regarding the business as a whole and increasing the familiarity with the "other fellow's" job. Their usefulness, however, depends largely upon the chairman and his guidance of the discussion, for, unless properly handled, such meetings may easily decline into mere exchanges of "hot air," without much actual value. What is needed is helpful suggestion, intelligent questioning and discussion, and the disposition to make the most of the opportunity to get information from the "other fellow," and to give freely any information which might be of value to him.

Such gatherings fail largely if they do not include an element of fellowship. The really useful part of technical meetings is, in general, the personal contact, the interchange of ideas by small groups of men, where the talk is more or less confidential and without the restraint of the open meeting.

VII. *Training School.*—One difficulty experienced at association meetings is the tendency of the discussion to develop into a recital of individual and company results and achievements, without bringing out the important points as to the methods by which the results were secured. Recitals of this nature usually offer little meat, and the listener rapidly loses interest in the proceedings. This is particularly true as you go further down the line, and the employees in the less advanced departments soon feel that they are not getting enough out of the meetings for the time spent. A good chairman will correct this tendency and keep the meeting interesting, but at the best the number of those taking part in the discussion is small, and the great majority play a passive part. The remedy for this would seem the assigning to each person in attendance of something definite to do, and for this reason the training school assumes great importance. If a man can be induced not only to attend sessions and listen to lectures and discussions, but also to think coherently, if he can be made to feel that he is achieving something, then the session will be worth while.

Every large undertaking should have a training school, under competent management, providing for definite contributions by every scholar. The organization would without question be well repaid for the time and care given.

VIII. *Social Functions.*—Under this head there is a great deal of disagreement. Some companies are strong believers in entertainments to bring the employees into closer personal touch with one another. Others hold that it is best to let such personal acquaintance follow natural lines, and that kindred spirits will, in the usual course of things, gravitate to one another. Actual experience is rather in favor of a natural arrangement of social functions, so that acquaintanceship among employees of different departments may be fostered without being forced. Such entertainments must, of course, be planed along lines which will prevent breaking up into cliques, which unfortunately frequently happens.

It is difficult to lay out definite lines, as much depends upon the personnel and characteristics of the committee in charge, or the part played by the heads of departments, and the attitude taken by the employees as a whole. It is probable that of all forms of entertainment, field days are the greatest levelers, as, with a carefully arranged programme, there will be something of interest to every participant. Amateur theatricals are of more limited value. Purely social gatherings, such as dances, boat rides, etc., where the part played by the individual may be largely passive, are less likely to realize the best results. The formation of cliques is highly probable, and the success of the undertaking depends almost entirely upon the presence of some master spirits particularly happy in breaking down the barriers which already exist or which threaten to be raised. But far the safest form is that in which every person has something to contribute to the occasion as a whole. Lunch clubs have points worthy of study, as at such times there is a natural tendency to talk over the more immediate problems, and many subjects are their taken up which would otherwise be passed over for lack of opportunity to discuss them.

IX. *Profit Sharing.*—Profit sharing schemes have proved successful in establishing closer and more interested relations between departments and between individuals. The employee, as his holdings in the company increase, naturally takes a growing owner's interest in the operation of the business, and as his dividends are paid him he becomes more keenly aware of the necessity for efficient and intelligent service throughout the whole organization. He becomes, therefore, more receptive to helpful criticism and is more likely to offer suggestions himself.

In many industries a definite system of bonuses or rewards is in force, whereby suggestions, plans, ideas, unusual contributions of any kind, outside of the direct field of the employee's work, are paid for if acceptsd. This should prove valuable for two reasons: First, it broadens the employee, tends to develop his ability to do intelligent and constructive thinking, and to bring home to him the necessity for knowing about his own and his fellow's work; second, it will enable the executive to single out the more intelligent workers, and will help him to fit them to the positions for which they are best suited.

X. *The Non Co-operator.*—There are three clssses of non co-operator:

1. The man who does not co-operate, through ignorance.
2. The deliberate, non co-operator who is willing to meet the other fellow half-way.
3. The man who does not co operate, through laziness, indifference or inertia.

The one who fails through ignorance may always, by teaching, be rounded into a useful part of the machinery. The man who is a deliberate non co-operator is a more difficult problem and his case must be dealt with according to the understood requirements of the organization. If otherwise valuable, he could probably be brought to see the error of his ways. For the sake of the effect on the organization as a whole, however, it would often be necessary to get rid of him. If allowed to remain uncorrected, even though a valuable worker, he will scatter grit throughout the entire mechanism. In his case it would hardly prove lastingly effective to point out that co-operation is a required part of his job, and sooner or later he will have to go. There is possibly a fourth division—the non co-operator through timidity, who is afraid of stepping on the other fellow's toes. In this case the remedy is in the hands of his superiors, who should take pains to draw him out and encourage him.

One of two courses would occasionally prove advisable in eradicating cases of poor co-operation. If the fault is the individuals, he might be transferred in series to the different departments with which his co-operation is needed, so he may get first-hand knowledge of their requirements, routine and problems. On returning to his own duties he can hardly fail to be a more intelligent and useful part of the mechanism. If the trouble is with a group or department, the man directly in charge might be detailed to make a general study of co operation without specifically referring to his own work, and be required to turn in a report, with recommendations, pointing out weaknesses, and corrections required. He could not help discovering the faults in his own jurisdiction, and would see that these were remedied.

XI. *Miscellaneous.*—In many organizations company periodicals containing contributions from all grades and departments have promoted enthusiasm, increased knowledge of inter-departmental methods, and served as vehicles for valuable suggestions, etc. The keynote of co operation is good service, and employees should be schooled in the idea that every action should tend to the rendering of good service, and that every plan should be made with this end in view. Bettering the service will inevitably mean improving the company's condition; and, conversely, every increase in efficiency, every obstacle overcome, and friction eliminated must result in better service to the community. Summarizing we find the following specific suggestions:

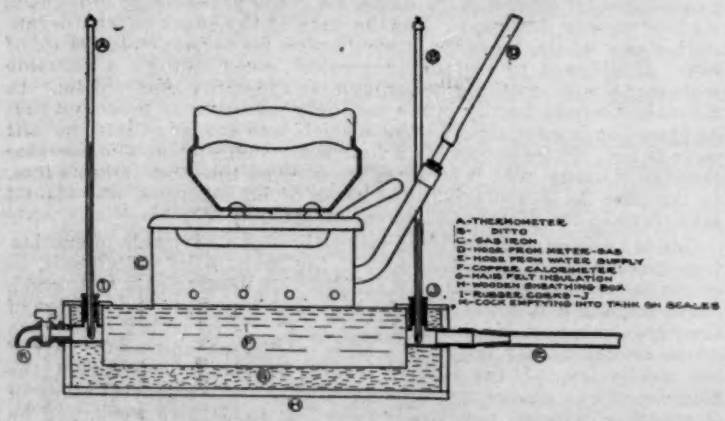
1. The establishment of a definite cabinet, the use of organization charts, and the maintenance of clean-cut lines of responsibility.
2. Schooling employees in the work of grades above and below them, in the interlocking work of other departments, and periodic meetings of sub-department heads and chief clerks.
3. The effective use of inter-departmental committees on departmental functions, including a grievance committee, and the elimination of criticism of any department or individual in the presence of a customer.
4. The training of selected employees in the work of several departments; the establishment of a "flying squad" of supernumeraries.
5. Inter departmental promotion of efficient and versatile employees.
6. The establishment of local or company sections of technical associations, efficiency clubs, etc., under careful direction.
7. The establishment of training schools, with particular care that the students bring definite contributions to the work undertaken.
8. Social functions, such as field days, etc., where opportunity is afforded for recreation acceptable to all attending, planned so that every person shall contribute in some way.
9. The establishment of a system of profit sharing, including rewards for valuable ideas.
10. Elimination of the non-co-operator, either by education or discharge.
11. The publication of company periodicals; and constant teaching that *good service* is (first, last and all the time) the goal sought.

XII. *The Executive.*—When all is said and done the establishment and maintenance of close relations and harmonious co-operation depend upon the executive. His influence and personal touch are felt in every branch and fiber of the organization. An enthusiastic per

sonal interest, the will to bring out the utmost in co-operation, the ability to have his cabinet working *with* him rather than *for* him, are potent factors. Without the attendance of the executive, meetings of heads of departments lose a large part of their value. The successful executive guides the discussion along the more important lines and from them gains information on which to base his actions. He keeps in touch with the work of inter-departmental committees, and his interest in their progress and achievements shows the ideal president should be a leader rather than a dictator or a mere office from which orders issue—a person rather than an official; and one sign of a healthy organization is that the executive is known among the employees as "Mr. Blank" rather than as "The President."

New Methods and Appliances.

THERMAL PERFORMANCE OF A GAS IRON.—Mr. H. M. Riley, in the Baltimore "Gas and Electric News," gives this method: From a thermal standpoint the heat units radiated by the face of an Iron are an index of its usefulness. Accordingly, we may speak of its efficiency as the ratio of its face radiation to the total heat supplied to the iron. From a practical standpoint the iron must have, in addition, sufficient weight and thickness of face metal to insure good work, qualitatively and quantitatively. However, the practical and thermal considerations are so intimately related that we can say, if it performs well under a thermal test, it will do so in practical use. In this investigation the chief problem was to construct an apparatus to measure the heat radiated by the face of the iron. As shown in the illustration, it consists of a shallow copper receptacle, much the



shape of a cigar box, set in a wooden box and lagged with hair-felt to prevent radiation. At one end is an inlet and at the other an outlet both provided with thermometers, and inside are water baffles. The test consisted in passing water through the box at a constant rate, lighting the iron and placing it on the box, and when the temperature of the outlet water has become constant, the following readings are recorded every 2 minutes:

a. Meter reading.
b. Room and gas temperature.
c. Barometer.
d. Inlet calorimeter temperature.
e. Outlet calorimeter temperature.
f. Vent temperature.
g. Water passed.

It was also necessary to ascertain how much heat the calorimeter was losing. This was done by covering its top with one thickness of hair felt and passing through water heated to the same temperature as the outlet water during the test proper and at the same rate of flow. The drop in temperature, and the time, and the water passed, give the B.T.U.'s lost per minute per pound of water passed. The resulting heat units radiated, added to the heat imparted to the water, are the heat given out by the face of the iron. During the test that part of the calorimeter top not covered by the face of the iron is covered with one thickness of hair-felt. The data and calculations follow:

Cubic feet of gas burned at 60° F. and 30 inches...	3.64
Temperature inlet water	71.67° F.
" outlet water	77.40° F.
" flue gas.....	574° F.
" of room and gas	76.5° F.
Water heated	200 pounds.
B. T. U. in gas at 60° and 30 inches.....	600

Other data necessary for the calculations are:

Composition of the gas; analyses of flue gases; surface area of calorimeter; area of face of iron; length of test; weight of the iron. When all those are known we can determine the percentage of useful heat given off by the face of the iron, or construct a complete heat balance.

THE WELSBACH SYSTEM OF ILLUMINATING BOWLING ALLEYS.—The Welsbach Company has issued from its Gloucester (N. J.) headquarters a well-put-together vest pocket folder, bearing the title "For Bowling Alley Illumination: The Reflex-20." The text and accompanying illustrations nicely detail the plan and method. It is noted that a suitable light for a modern double-alley is found in two "Reflex-20" lamps, equipped with No. 242 aluminum reflectors, one directly over the foul line, the other being placed 8 to 10 feet forward; the mantles if possible should be 8 feet from the floor. The reflector is so shaped that the light source is masked from the eyes of the bowlers, all the light being projected forward in the alleys, thus eliminating glare from the polished floor and sharply defining the foul line. All of which means material assistance to the player. For the suitable illumination of the pins the Welsbach folks recommend a standard size "Reflex" light, 1½ to 2 feet in front of each set, the mantle being placed 5 feet from the floor and equipped with the No. 524, enameled steel reflector. Experience has shown that this plan and method place the pins in a distinctly bright field, the background being kept dark.

A "MISCELLANEOUS ORDER" CARD.—The appended concise form is one arranged by Mr. William H. Matlack, Jr., of the Henrico County Gas Company, Barton Heights, Va.—it is in duplicate, on a perforated overfold sheet:

Henrico County Gas Co.

Order No ... MISCELLANEOUS ORDER. Original

Telephone to ..... Time ..... Date.....
Name.....
Location.....
Nature of Order .....
.....
.....
.....
Work Done.....

Customer please sign below, provided complaint or work has been satisfactorily attended to, otherwise write "No" in place of signature, and in addition write note on ticket stating just what is not satisfactory.

Attended to by .....Fitter
Attended to by .....Helper
Time on Job .....
Date .....
.....
(Customer Sign Here)

Items of Interest
FROM VARIOUS LOCALITIES.

THE colony of Mediapolis, Ia., has been selling gas from its municipal plant to ordinary consumers at the rate of $1.25 per 1,000; but the authorities claim this price did not cover the cost of manufacture and distribution. Accordingly the users have been notified that the price hereafter will be $1.50 per 1,000, gross, less 10 per cent. for prompt payment. The Company at Brighton, Ia., charges $2 per 1,000. Both places follow an indeterminate system of manufacture; but the product is not altogether dependable.

ANOTHER instance of odd construction and manufacturing methods is reported from Pana, Ills., where, the 5th inst., the proprietors of the Peoples Gas Company certified to an increase of $50,000 in its capitalization, which now amounts to $100,000. The correspondent who forwards the news also stated: "The Company is composed solely of home business men and operated by home capital. It commenced to supply gas in August, 1912, and from the very outset the business has been a paying one. In fact the resources of the plant have been so freely drawn on that the owners have ordered an additional generating machine, waste heat boiler, and the necessary connections, from the American Gas Construction Company, Newton, Ia. The present capacity is 75,000 cubic feet in 24 hours. Manager Vidler is also constructing a brick addition for housing the new apparatus. Altogether the betterments involve an expenditure of $15,000."

MR. JOHN QUIGLEY, a former Cashier of the Brooklyn Union (N. Y) Gas Company—in fact he was active as such until the close of 1911—died, at his home, No. 135 North Portland avenue, the morning of December 8th. He had been in poor physical condition for a lengthy period. He is survived by his wife.

MR. LEONIDAS MERRITT, the capable Manager of the Water and Light Department, Duluth, Minn., at a recent meeting of the West Duluth Commercial Club, stated that he was negotiating with the Zenith Furnace Company with a view of getting a cheaper gas rate than the one now in force. Builders might do well to keep in touch with Mr. Merritt, for extensions will soon have to be made in connection with the Duluth works.

THE Fargo (N. D.) Gas Company, as our readers generally know, is being sued by certain residents who are seeking to have the plant removed and reconstructed on a site exterior to the city limits, the basis of the complaint being the contention that the plant constitutes

a nuisance, and is a danger to the community. The Fargo plant is owned and operated by the H. M. Byllesby Company, of Chicago. The importance of the underlying matter was such that the Byllesby's defence involved the retaining of these experts, whose fame as gas engineers is not confined to the United States: Wm. B. Miller, Chief Engineer, the National Chamber Coke Oven Compaay, Cincinnati; O. O. Thwing, Chief Engineer, Western Gas Construction Company, Fort Wayne, Ind.; and Wm. A. Baehr and Henry I. Lea, Consulting Engineers, Chicago. The case is naturally considered important, in and through its possible bearing on other situations of resemblance or similarity throughout the country. The decision is being awaited with interest.

THE agitators who decried the quality of the gas supplied to the residents of Biloxi, Miss., and who complained loudly of the indifference in general to their objections by the operators of the Coast Gas Company, of Biloxi, will likely not relish the public announcement recently made by the Company's Manager, Mr. M. W. Bogart. The latter declares he will welcome and assist in making an investigation on the part of the authorities as to the quality of the Company's service. In order that the authorities may not be put to the expense of purchasing expensive apparatus to make the necessary test, the Company offers its laboratory equipment and every other facility it controls, to the authorities while making the test.

THE Omaha (Neb.) gas rate hearing has been set for the first Monday in January. "Prof." Wm. D. Marks, who is said to be now a resident of New York city, is to represent Omaha in matters of valuation and rate making, and the owners of the Omaha property (the U. G. I. Company, Philadelphia) will be represented by Mr. Henry I. Lea, of Chicago.

DIRECTOR COOKE, having advertised for bids for affording illumination to the districts of Philadelphia not reached by gas mains, by means of Welsbach type, gasoline burners, rejected the only bid submitted, that by the Welsbach Street Lighting Company, at the rate of $32 per year, per lamp—there are about 20,000 of these. The Director declares that he rejected the bid because it was in excess ($3 per lamp) of the rate of last year; whereas he confidently expected a positive reduction. Also, that there was no competition. As far as the main objection is concerned, we have no hesitation in saying that, were the cost of gasoline to day equal to that charged for it in 1912, the Company would gladly go it on the $29 per lamp per annum basis of 1913. The Director is not fair in his demur.

ANOTHER further gas hearing is on for January next. The place is Lincoln, Neb., and the main inquiries concern valuation and rate making. The city is represented by that eminent economist (of other peoples' goods) Mr. Alton D. Adams, of Worcester, Mass.; and the operating corporation (H. L. Doherty & Co.) is to be represented by Mr. Henry I. Lea, of Chicago.

AT a meeting of the Philadelphia Operative Builders' Association, held the 11th inst., a resolution was adopted to the effect that the equipment of the all-gas kitchen type of modern, ordinary home dwelling be strongly recommended for continuance. The annual election for officers resulted in the following choices: President, H. Brocklehurst; First Vice President, H. Diesel; Second Vice-President, H. H. Heist; Treasurer, S. Shoemaker; Secretary, A. Ferguson.

AT a meeting of the Directors of the Albany (N. Y.) Municipal Gas Company, Secretary Wm. G. Furlong was instructed to make public this announcement respecting an amended gas rate schedule, operative January 1, 1914: A net rate of $1.10 per 1,000; January 1, 1915, $1.05 per 1,000; January 1, 1916, $1 per 1,000.

AS the result of a change in the control of the Austin (Tex.) Gas Light Company, Mr. H. M. Moore (in charge since 1902) resigned from its management. His successor is Mr. D. G. Skinner, of Chicago.

THIS mention may serve as a prelude to some short mention of the growth of the Company since he assumed control of its affairs—July 15, 1902: An average 24-hour sendout then was 35,000 cubic feet; today it is 250,000 cubic feet; then there were 125 gas ranges, 40 gas arcs, and 300 straight measuring meters on the lines. Now the relative figures are: Meters, 3,100; gas arcs, 500; gas ranges, 3,000. Then, a rather antiquated plant comprised one 5 foot Lowe water gas set, 2 rickety benches of 5's; and 2 holders, of respectively 60,000 cubic feet and 18,000 cubic feet capacity. Now the apparatus includes: Duplicate water gas sets, 7½ feet; 3 modern benches of 6's; duplicate exhausters, compressors, oil pumps, water pumps and blowers. Also, a concrete tar well up to retaining 16,000 gallons, buildings (steel and iron) of modern construction, a storage holder equal to receiving 200,000 cubic feet, and a relief holder, the capacity of which is 75,000. To sum it up, the daily capacity of the new plant has a maximum of 800,000 cubic feet.

THE Albany (N. Y) *Journal*, of the 11th inst., says that the action of the Public Service Commission, in granting the Troy (N. Y.) Gas Company the right to issue of $1,880,000 par value of common stock, or convertible notes, to be sold at not less than par, has done much to strengthen the rumor, very persistent of late, that the Municipal Gas Company (Albany) and the Troy Gas Company are about to be consolidated. The Troy Company's new issue was granted with the object of reimbursing its treasury for expenditures and to pay obligations outstanding since last December. This issue brings the capital stock of the Troy corporation to $2,180,000. In connection with this it may be noted that the Municipal Gas Company was recently granted permission to emit additional stock to the amount of $4,000,000, which brings its total capital aggregation up to $6,100,000. Meanwhile it is rather satisfying to remark that reason is at last to prevail in the gas supply of Albany and Troy, which unification of interests should have taken place 20 years ago.

ON the 19th inst. Commissioner Douglas was to have heard the complaint of the Mayor and Common Council of Oswego, N. Y., against the Peoples Gas and Electric Company, respecting the rates charged by it in the named place. There is quite a bit of buncombe involved in this complaint, especially on the part of one of the Councilmen, who is always on the stump against any local interest in which he has no personal financial concern.

THE Massachusetts Board of Gas and Electric Light Commissioners has granted the necessary license to the proprietors of the Cambridge Gas Light Company, under which they may issue 1,200 additional shares of capital stock, at the rate of $200 per share, the proceeds to be used in payment for additions and betterments to the Company's manufacturing system.

MR. L. V. RYERSON, writing from San Francisco some days ago, incloses this mention, which goes to show that a settlement is possible of the long standing controversy between the two sections of electric workers involved in the strike ordered by the Light and Power Labor Council against the Pacific Gas and Electric Company. Continuing, we are told: "It is understood that a tentative agreement, acceptable to all parties concerned, has been drawn up and will be presented, by Samuel Gompers, President American Federation of Labor, to the representatives of the Pacific Gas and Electric Company. It is understood the tentative agreement provides for a return to work of the Reid-Murphy electrical workers, who have been 'on strike' against the gas division of the Company since last May; that an increase in wages shall be granted; and that no discrimination shall lodge against the strikers in respect of re-employment. It is further understood that the Reid-Murphy faction will eventually reaffiliate with the recognized International Brotherhood of Electrical Workers affiliated with the A. F. of L." Thus ends a miserable strife that has lasted for over two-thirds of a year, during the continuance of which the users of artificial light were disturbed, the suppliers thereof were hampered and saddled with abnormal, useless expenditure, and the men were impoverished, to the point of utter demoralization. And, all of this to what end? That the "dignity" of labor should be upheld through the carrying out of a ukase by the leaders of a crew who fatten on the miseries entailed on actual labor merely to show, in the rottenest sort of way, their political prowess!

THE Philadelphia *Telegraph*, of recent date, in a very well told story describing some of the interesting things shown in Horticultural Hall during the week of the meeting of the National Commercial Gas Association, had this to say, anent certain industrial gas appliances: "* * * None are more interesting than the gas vacuum cleaners, the daylight producers, and the kitchen-sized, garbage incinerators."

A VERY peculiar accident was recently settled out-of court in this city. One Constantine Okuta (399 Java street, Greenpoint), while working in the shaft of the Astoria Company's tunnels under the East river, was struck on the head by a round stone, of the cobble variety, which dropped from a bucket which he had helped to fill. Okuta brought suit, and the case was to be tried December 9th last, just 3 years from the time the accident happened.

THE Brockton (Mass.) Gas Light Company's Employees' Association, largely through the insistence of Manager E. B. Mooney, of the Company, and President James P. Moran, of the Association, has voted to form Classes amongst the members for their better instruction.

"F. J. K." writing to us recently, says: The JOURNAL, and its readers, will share to the full with us in sorrowing over the two sad and shocking events that happened within a very short space to Mr. W. M. Kapus, Manager, the Northwest Gas Equipment Company, Portland, Ore. While making the journey, from Portland to San Jose, Cal., to attend the meeting in September last of the Pacific Coast Gas Association, through the overturning of their touring car, his estimable wife was fatally injured. The second miserable chapter told of the death of his mother, the telegraphic advices respecting which sad event were handed him while preparing to return home, immediately after the adjournment of the Philadelphia sessions this month of the National Commercial Gas Association.

THE proprietors of the Kingston (N. Y.) Gas and Electric Company have purchased the plant and other properties of the Saugerties (N.Y.) Lighting Company, and will operate the same actively early in January.

The Market FOR GAS SECURITIES.

Dullness continues to rule in respect of city gas share quotations, but to the optimistic there is the support that comes from seeming strength. Possibly the better expression would be that the figures indicate lack of weakness. Consolidated came in to-day (Friday) at 127½ bid, which is just a half point over the introductory of a week ago.

Brooklyn Union is without change, although it may be noted that in the week some sales were made in it at 127¾, and 127½ is bid to-day.

The Brooklyn Borough Company was authorized this week to issue $125,000 new stock, the proceeds from which are to be expended in the purchase of real estate, and for much needed betterments.

In the general gas share market, U. G. I. shares are strong, 205 having changed hands in the Philadelphia Exchange yesterday at 166 to 166½. The outlook for this seems to forecast a brisk rise before mid-January.

Peoples, of Chicago, is dull and lower, which condition shows the absolute apathy of the investing public, the lenders in this line evidently preferring to loan on call at any rate suggested by borrowers, as long as the borrower will pledge an equity of 200 or so. However, the retiring ways of capital often lead to shrinkages in income, even though plenty of opportunity exists for investments that are fully as secure as the credits of the Nation, State or city.

Lacledes are absolutely lifeless and low; Eastern gas securities are, as a rule, inert—in fact it is so that accredited Eastern States gas securities are held on a 4 per cent. basis; and gas bonds of all sorts are in demand. To show how active these are we here report sales in them made yesterday on the Exchange: California Gas and Electric 5's, $3,000 at 91; Consumers, Chicago, 5's, $2,000 at 99; Newark (N.J.) gas, 5's, $3,000 at 101½; N. Y. Gas, Electric L. H. and P., 5's, $2,000, at 101⅝ Ogden (Chicago) gas, $1,000 at 53; Peoples gas, refunding 5's, $3,000 at 98½.

Chicago bond houses have been invited to subscribe to $3,000,000, new general mortgage 5's, all bids to be in by the first prox. And W. A. Read & Co., of Chicago, have purchased $1,405,000 Detroit City gas, general mortgage 5's, at about par. The Cincinnati Gas and Electric Company has declared a quarterly of 1¼ per cent, payable the 2d prox. The U. G. I. quarterly of 2 is payable the 15th prox., to record holders of the 31st inst.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.
115 BROADWAY, NEW YORK CITY.

DECEMBER 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$99,816,500	100	127¾	128
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	8,500,000	1,000	101	103
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	101	104
Mutual Gas Co.	3,500,000	100	157	157
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99	101
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	59	62
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	98	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	102
Standard	5,000,000	100	102	104
Preferred	5,000,000	100	93	94
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	90	95
The Brooklyn Union	15,000,000	1,000	121¾	123
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	200,650	500	180	—
Out-of-Town Companies.				
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Chicago Gas Co. Guaranteed				
Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	67	69
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus Gas Light & Fuel				
Company	1,682,750	100	65¾	66¼
Preferred	3,028,500	100	33	35¼
Consolidated, Baltimore	13,460,084		118¾	119
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore				
City, 4½	2,751,000	—		—
Essex and Hudson Gas Co.	6,500,000	—	133	136
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	138
" Bonds, 5's	10,500,000	—	101	106
Indianapolis	2,000,000	—	85	90
" Bonds, 5's	2,650,000	—	90	98
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Laclede Gas Co., St. Louis.	10,000,000	100	93	95
Preferred	2,500,006	100	—	102½
Bonds	10,000,000	1,000	102½	103
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	88¾	89
Preferred	25,000,000	100	91	92½
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	116	116½
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Pacific Gas and Electric Co.	15,500,000	—	33¾	35
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	8
United Gas Imp. Co.	55,502,960	50	167	168

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

Alabama Light and Traction Company.—Annual meeting, May ——1914. Officers, President, R. L. Ellis, Selma; Treasurer and Secretary, H. O. Hanson, Mobile.

American Gas Institute.—Annual meeting, New York, October 21, 23, 1914. Officers: President, W. H. Gartley, Philadelphia. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting————1914. Officers: President, A. A. Dion, Ottawa; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1914. Officers: President, J. T. Hutchings, Bochester, N. Y.; Secretary, C. H. B Chapin, 29 W. 39th street. New York City.

Gas Meeters.—Monthly Section Meetings; Grand Commissioner, Will. W. Barnes. East Orange, N. J.; Gen'l Sec'y, H Thurston Owens, La Crosse, Wis.; New York Section, Chairman, W. H. Pettes; Secretary, G. E. Smith, Sipp Avenue, Jersey City, N. J Philadelphia Section; Chairman, Stanley Grady; Secretary, H. E. Stitzler, Broad and Arch streets. Cleveland Section, Chairman, F. R. Hutchinson; Secretary, Wm. Holtz, East Ohio Gas Co. New England Section, Chairman, T. W. Jennings, Boston; Sec., F. K. Wells, 99 Broad street, Boston. Winona Section, Winona, Minn., W. F. Clausen, Chairman. Bethlehem Section, Trueman Weithnecht, Chairman; Sec.-Treas., Truman Buss. South Bethlehem, Pa.

Guild of Gas Managers of New England.—Annual meeting, March, 1914. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 18th and 19th, 1914. Chicago, Ills. Officers: President, W. F. Barrett, Chicago, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, Cleveland, O., September, 1914. Meetings of Sections, monthly. Pres., Charles O. Bond; General Secretary, J. D. Israel, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. R. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March 11 and 12, 1914. Terre Haute. Officers: President, A. S. Cooke, Terre Haute; Vice-President, A. C. Blinn, Evansville; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Davenport, May 27, 28, 29, 1914 Officers: President, B. C. Adams, Lincoln, Neb.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October—— 1914 Arkansas City. Officers: President, Al. Newman, Arkansas City; Secretary and Treasurer, Ivan Thomas, Wichita Kas.

Michigan Gas Association.—Annual meeting, September, 1914. Place, undetermined. Officers: President, H. W. Douglas, Ann Arbor, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1914. Mexico, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting, Dec. ——1914, Minneapolis, Minn. Officers: President, P. S. Young, Newark, N. J.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, St. Louis, Mo., May 19 and 20, 1914: Officers: President, E. L. Brundrett, Kansas City, Mo.; Secy-Treas., T. Clive Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 18th and 19th, 1914. Boston Officers: President, T. H. Hintze, Providence, R. I.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Next Meeting, —— ——, 1914, Asbury Park N.J. President, C. F. Butcher, Freehold, N. J.; Sec'y-Treasurer, O. F. Potter, Newark, N. J.

Ohio Gas Association.—Annual meeting, February ——— 1914 Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, Oklahoma City, May, ——1914. President, F. E. Bowman, Ada; Secretary-Treasurer, H. V. Bose, Oklahoma City.

Pacific Coast Gas Association.—Annual meeting, Long Beach, Cal., September ——— 1914 Officers: President, C. S Vance, Los Angeles, Cal.; Secretary-Treasurer, Henry B stwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Allentown, Pa., April ———, 1914; Officers, President, J. A. Frick, Allentown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 11, 1913: monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city.

Southern Gas Association.—Annual meeting, Mobile, Ala., April 4, 1914. Officers: President, James Fernier, Rome, Ga.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting, May 22, 23 and 24, 1914, Galveston, Tex. Officers: President, G. H. Gifford, Fort Worth Tex.; Secretary-Treas., J. D. Walker, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May ———1914, Milwaukee, Wis. Officers: President, Ewald Hasse, Milwaukee, Wis.; Secretary-Treasurer, Henry Harman, Milwaukee, Wis.